SEP 18 1917

VOL. LXXXI, No. 2074. [All Rights Reserved.] AUGUST 24, 1917. [Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage.] PRICE FOURPENCE.

LONDON: PUBLISHING OFFICE, 4, LUDGATE HILL, E.C. 4 SUBSCRIPTION per annum, Postage inclusive, in Great Britain, £1 1s. 8d. Canada, £1 3s. 10d. ($5.80); to all other countries, 30s.—NEW YORK: D. VAN NOSTRAND CO., 25, Park Place, New York City. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. PARIS: BOYVEAU & CHEVILLET, Librairie, Etrangère, 22, Rue de la Banque.
Telegraphic Address: "Ageekay, Cent., London." A B C Code. Telephone Nos. City 997; Central 4425 (Editorial only).

MOULDED INSULATORS
Of all Descriptions.
LITHOLITE, Ltd.,
65-67, Hackney Grove, London, N.E.

SILUMINITE.
Fireproof—Non-Hygroscopic—High Resistant.
The New and Best Insulating Material having qualities and characteristics possessed by no other Insulating Material.
THE SILUMINITE INSULATOR CO., Ltd.,
The Green, Southall, Middlesex.
'Phone: Southall 59. Telegrams: "Tubes, London."

H. T. FERGUSON, PAILIN & Co., LIMITED, A. C.
SWITCHBOARDS
L. T. EDWARD ST., Nr. Openshaw, MANCHESTER. Tel: 280 Openshaw. C. D.

INSTRUMENTS, CIRCUIT-BREAKERS,
AUTO-CUT-IN & CUT-OUTS.
The Record Electrical Co., Ltd.
BROADHEATH, MANCHESTER.
TELEPHONE: 164 ALTRINCHAM.

BROOK
Single-, Two- and Three-Phase Motors
LONDON, LEEDS and HUDDERSFIELD.
See Advertisement Sup. 34.

SWITCHGEAR.
ERNEST F. MOY, LTD.,
Manufacturing Electrical Engineers and Government Contractors.
GREENLAND PLACE, CAMDEN TOWN, LONDON.

NEW DISTRIBUTION BOXES.
THE CANTIE PATENT FUSE WILL CLEAR A "DEAD SHORT."
ALL CONNECTIONS FROM FRONT.
THE CANTIE SWITCH CO., LTD.,
67, MOUNT ST., NOTTINGHAM.

THE **SAXONIA**
ELECTRICAL WIRE CO., LTD.,
ALWAYS GREENWICH, S.E.
ALL BRITISH
FLEXIBLE CABLES.

CHURTON
SINGLE and POLYPHASE
MOTORS.
T. HARDING CHURTON & CO., LTD.,
Atlas Works, Water Lane, LEEDS.

LIFTS and - - - TRANSPORTERS.
Wm. WADSWORTH & SONS, LTD.,
BOLTON.

"EMPIRE"
AUTOMATIC CONTROL
FOR
Shell Presses, Compressors, Machine Tools.
ELECTRIC CONTROL LIMITED. GLASGOW.

WESTERN-ELECTRIC
COMPANY, LIMITED,
Norfolk House, Victoria Embankment, W.C.
Works: NORTH WOOLWICH, LONDON, E.
TELEPHONES & CABLES.
See Advertisement this week, Sup. 22.

CONNOLLY BROS., Ltd.,
for
WIRES AND CABLES.
See Advertisement last week, p. iii.

WIRES & CABLES.
THE
WHOLESALE ELECTRICAL CO., LTD.,
54/56, Oxford Street, London, W.
'Phone: Museum 1897.

LABELS & BADGES,
Name Plates, Meter Dials, Switchboard Labels, Address and Instruction Plates, Advertising Novelties, Club Badges, Checks, Tokens, Blanks, Die Stampings, Dies, Press Tools, Punches and Cutters.
RELIANCE Engraving Co., Ltd., CHISWICK.

JULIUS SAX & CO., Ltd.
EST. 1865.
24A, HIGH STREET, LONDON, W.C. 1.

CABLES AND WIRES
SWITCHBOARDS.
TRANSFORMERS.
JOHNSON & PHILLIPS, LTD.,
CHARLTON, LONDON, S.E.

Glasgow Office: 68, Gordon St.
OPENSHAW, DYNAMOS ELECTROMOTORS, Ltd. MOTORS MANCHESTER.
London Office: 49, Queen Victoria St., E.C.

START LIGHT.
THE
WOODHOUSE AUTOMATIC CLUTCH
PICKS UP LOAD AFTER STARTING.
THE VICTORIA DYNAMO & MOTOR CO.,
CRAVEN HOUSE, KINGSWAY, W.C. 2

MAVOR & COULSON, Ltd.,
GLASGOW.
MOTORS, DYNAMOS, SWITCHGEAR.

"WHITE STAR" LAMPS
DRAWN WIRE.
The "RUGBY" CARBON FILAMENT and RADIATOR LAMPS.
THE LONDON & RUGBY ENGINEERING CO., LTD.,
36 & 37, Queen Street, E.C. 4
Telephone: City 5252.

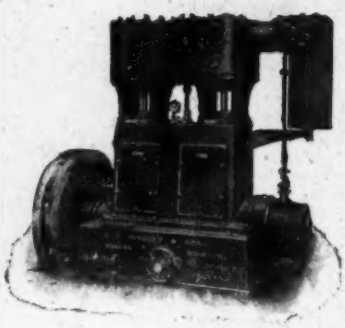
THERMIT, LIMITED,
675, COMMERCIAL ROAD,
'Phone: EAST 4157. LONDON, E. 14 Grams: "Fulmen Step, London."
PATENT
Alumino Thermic Welding Process.

LEA RECORDERS
for measuring
Boiler Feed Water
and Condensed Steam.
The LEA RECORDER CO., Ltd., Deansgate, Manchester.

—M·E·M—
List free. MIDLAND ELEC. Mfg. CO., LTD., Barford St., B'HAM.
means greatest Design-Simplicity, embodying all known advantages, at marked moderate prices — in BRITISH
Ironclad Gear

Advertisement Index, see page xxviii.

VERTICAL HIGH SPEED ENCLOSED STEAM ENGINES.



SIMPLE and COMPOUND.

4 to 160 B.H.P.

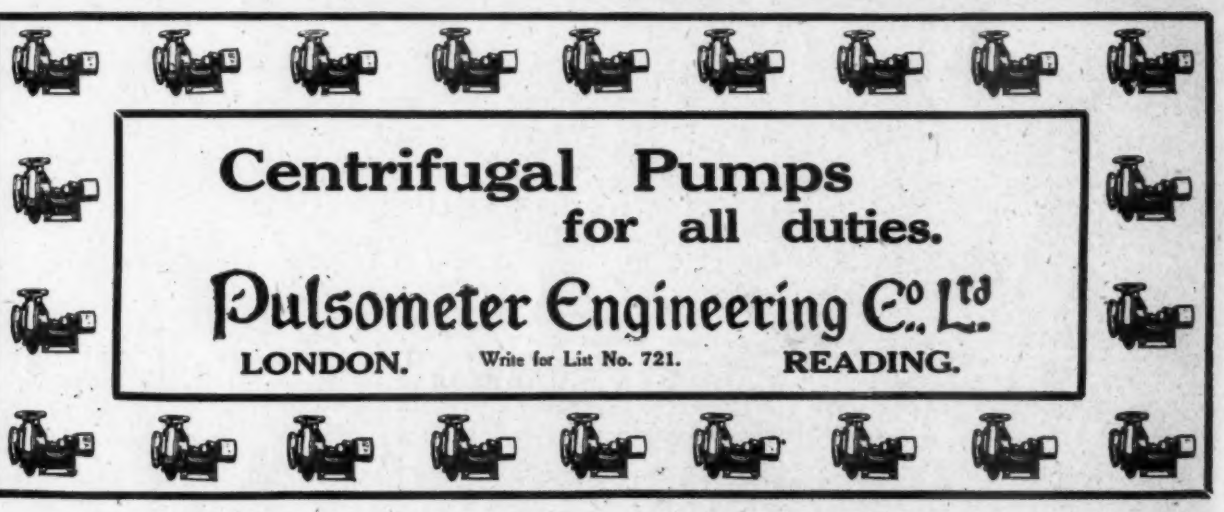
NOTE!

Substantial Construction.
Governor enclosed in Crank Case.
Convenient Oil Pressure Regulation.
Patent Duplex Reversible Strainer, can be cleaned whilst running.
Drip from Governor Valve Gland carried down through Vertical Rod to ground.

For DIRECT COUPLING TO DYNAMOS, FANS, PUMPS, Etc.
Silent Running, Economical and Reliable.
For SHIPLIGHTING and INDUSTRIAL WORKS OF ALL KINDS.
Write for further particulars.

E. S. Hindley & Sons, 11, Queen Victoria Street, LONDON, E.C.
Telegrams: City 9804. Steamport, LONDON.
Works: BOURTON, DORSET.

Also VERTICAL GAS and OIL ENGINES.



Centrifugal Pumps for all duties.

Pulsometer Engineering Co. Ltd
LONDON. Write for List No. 721. READING.

VULCANISED INDIA-RUBBER

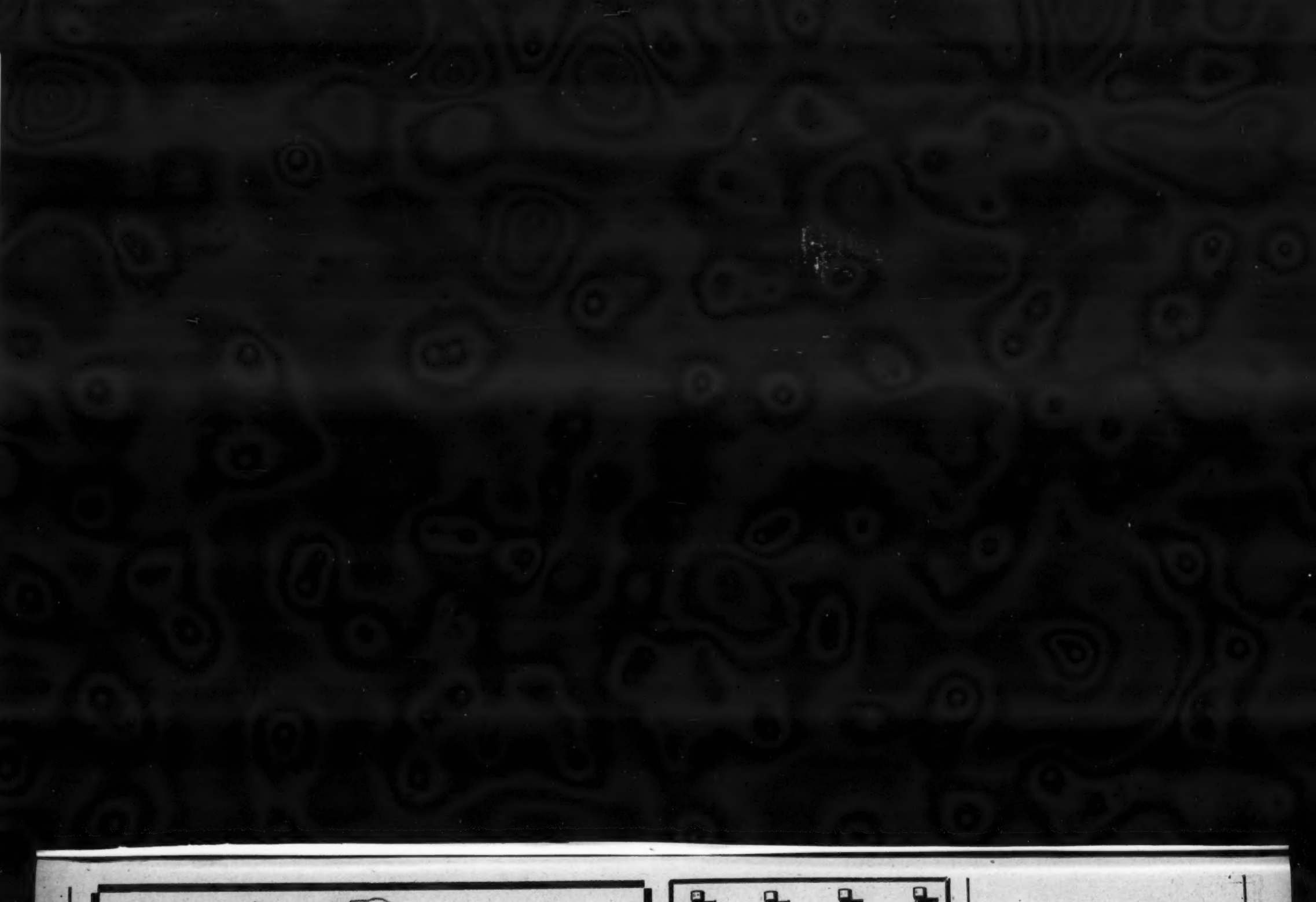
CABLE,

SWITCHGEAR, STARTERS, INSTRUMENTS, Etc.

DELIVERIES FROM STOCK.

ALL MANUFACTURED IN LONDON.

WM. GEIPEL & Co. HEAD OFFICE & WORKS: ST. THOMAS STREET, LONDON, S.E.
CABLE WORKS: WEMBLEY, LONDON.



THE

ELECTRICAL REVIEW.

VOL. LXXXI. AUGUST 24, 1917. No. 2,074.

ELECTRICAL REVIEW.

Vol. LXXXI.] CONTENTS: August 24, 1917. [No. 2,074.

	Page
Electrical Interconnection in Lancashire and Cheshire ...	169
Textile Power Costs	170
Industrial Reconstruction...	171
Reform in Education	171
V.B. Cable Breakdowns in the Tropics, by D. M. W. Hutchinson	172
Fault Localisation by Drop of Potential, by H. E. Blake (*illus.*)	172
The Examination of Commutation Conditions in Interpole Machines, by F. Murgatroyd (*illus.*)	173
The Production and Distribution of Power and its Influence on the Development of Irish Industry	174
Steel Trolley Wire	176
Industrial Reconstruction...	176
Trade Statistics of Spain	177
New Electrical Devices, Fittings and Plant (*illus.*)	178
Correspondence—	
Employment of Disabled Soldiers	179
The Psychology of Shift Work	180
War Items	180
Notes	183
City Notes	187
Stocks and Shares	188
Second Report of the Committee for the Interconnection of the Lancashire and Cheshire Electricity Supply Systems (*illus.*) (*continued*)	189
Foreign and Colonial Tariffs on Electrical Goods	192
New Patents Applied for, 1917	192
Abstracts of Published Specifications	192
Contractors' Column ... ... Advertisement page	xxii

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "ABKHAZ, LONDON." Code, A B C.

Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, to Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.

AUCKLAND N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31a, Strand Arcade, Queen Street.

BRISBANE: Gordon & Gotch, Queen St.

CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.

DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.

JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.

LAUNCESTON: Gordon & Gotch, Cimitiere Street.

MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.

MILAN: Fratelli Treves.

NEW YORK: D. Van Nostrand, 25, Park Place.

PARIS: Boyveau & Chevillet, 22, Rue de la Banque.

PERTH, W.A.: Gordon & Gotch, William Street.

ROME: Loescher & Co., Corso Umberto I° 307.

SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.

TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 123, Bay Street.

WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE "ELECTRICAL REVIEW'S"

ELECTRICAL & ALLIED TRADES DIRECTORY

(THE RED BOOK),

1917 EDITION

NOW READY.

H. ALABASTER, GATEHOUSE & KEMPE,

4, Ludgate Hill, London, E.C. 4.

ELECTRICAL INTERCONNECTION IN LANCASHIRE AND CHESHIRE.

WE referred in our last issue to the second report recently issued by the Committee for the Interconnection of the Lancashire and Cheshire Electricity Supply Systems, the contents of which were briefly outlined. Further perusal of the report leads us to the conclusion that the proposals are in the main so obviously dictated by commonsense considerations, and so clearly intended to operate with the single aim of providing an ample supply of cheap electricity for industrial purposes, that only minor criticism can be advanced by those who sympathise with the end in view. The Committee is thoroughly representative of the area concerned, and our only regret is that the company representatives, who did not sign the "additional powers" proposals of the Committee, have not more clearly defined their views. The reason for basing local authority representation on the Joint Board, on population, and company representation on capital outlay, is not self-apparent; neither appears to bear such a close relation to the electrical "figure of merit" of a supply authority as, for instance, output sold, which is a general indication either of initiative or favourable conditions. On the basis chosen, the 35 undertakings concerned would be represented by 90 members, including 11 representatives from four companies; as mentioned last week, these would be divided into four District Boards, which would elect a Central Executive of 20 members, two of whom would be special representatives of the Lancashire Power Co., in addition to its possible District Board representation. The Central Executive would have powers to elect a committee of six advisory engineers, one of whom would represent the Lancashire Power Co.

The capital expenditure of the municipal undertakings concerned on power stations, mains, &c., is £7,425,266, of which 43 per cent., or £3,166,274, has been redeemed; the corresponding capital value of the companies immediately concerned in the present proposals (exclusive of goodwill and investments) appears to be £1,021,645, of which only £73,218, or 7 per cent., has been written off. Although these figures have little bearing on the interconnection proposals of the Committee, they are of interest as showing the financial status of the two classes of undertaking in the area.

In passing, it should be emphasised that under the various powers associated with its interconnection proposals, the Committee specifically safeguards the right of appeal of individual authorities

to the proper Government Tribunal, as well as their existing rights as distributors within their statutory areas, and, moreover, lays down the principle of compensation for those authorities who are prejudicially affected by the operation of the scheme. Presumably, the latter contingency may arise if heavy expenditure is incurred on plant for bulk supply, &c., at the request of the Board.

As regards the second portion of the report, dealing with the proposed additional powers to establish and control all future and existing power stations and high-pressure transmission lines, it is pointed out that the 35 undertakings concerned generated 421 million units during the year ended March, 1916, and that in five years' time this output would under normal conditions expand to 1,000 millions, the maximum load increasing during the same period from 138,429 KW. to 300,000 KW., representing an average annual increase of 32,000 KW. This can be met by increasing the capacity of existing stations in some cases, while in others it would be desirable to erect new stations. The Committee states the case for co-ordination of effort at considerable length, finally arriving at the conclusion that the Board should possess the power to erect new stations and to acquire the ownership, control, and operation of all or any power stations, existing and future, and all high-pressure transmission lines. While we do not doubt the validity of these proposals, which would, if carried into effect, extinguish power company business, though leaving the ordinary statutory company no worse off than a corresponding local authority under similar circumstances, their *raison d'être* is not very clear, at any rate, as regards the more immediate future, having regard to the proposed powers of the Board for interconnection purposes, which include "to co-ordinate and *prescribe the running hours of existing stations* and to act in an advisory capacity in regard to *all proposals for future extensions* of generating plant."

For all practical purposes, the supply authorities and the Board appear to be identical. What is to prevent the Board in its wisdom from deciding that the future generating plant extensions of, say, half-a-dozen adjacent authorities should preferably be carried out jointly by them—under existing legislative powers—and on a site selected by the Board? In effect the same result would be obtained as if the Board proceeded under its "additional powers," with the exception that in the latter case the Board, *i.e.*, the whole of the authorities in the Lancashire and Cheshire scheme, would raise the capital and presumably share in the proceeds, while in the former case, only the authorities directly concerned would be interested financially. In either case, the operation would be controlled by the Board.

The proposals under "interconnection" were, moreover, adopted unanimously, while the "additional powers" have apparently led to a little rift within the lute.

No doubt the Committee has decided that the principle at stake renders the course which it has chosen worth while, although the powers of the Board for interconnection purposes, if we have correctly interpreted them, appear to be ample for the immediate future, and such as would automatically lead up to the proposed "additional powers." However, the Committee has, no doubt, had in mind the probability of some comprehensive effort by private interests to control bulk electricity supply in the future, and the proposals embodied in the Board's additional powers may be justified as indicating an alternative which is much more desirable in the interests of cheap electricity supply.

Textile Power Costs.

In a recent issue of the *Textile Recorder*, an article on "Power Costs a Vital Factor" discusses the alleged certainty of textile mill power costing more in the future than in the past, whatever method of obtaining power be adopted, and goes on to point out that the advantages at present possessed by a mill, in which the machinery stands in the books at a low figure, will be reduced materially if fuel costs keep on increasing. The writer briefly urges the necessity of obtaining the best results with whatever method is adopted, though evidently with a leaning towards electric driving, in connection with which he says that "first and foremost we must have cheap current," *i.e.*, in the cotton trade; the price per unit must compare favourably with the cost per horse-power, "then we shall reap to the full the advantages enumerated." These advantages include reduced transmission losses, abolition of smoke, even turning, cheap structures, higher production, &c.

This is all very interesting, but what proportion do power costs bear to the cost of placing manufactured cotton on the market? That such costs are as vital as suggested is unbelievable, bearing in mind the many archaic power installations which have in the past competed, and presumably still compete, with modern steam and electrical installations. The explanation that power plant investments have been written-off in the older installations cannot apply in all cases, yet the older mills survive, despite high power costs. Perhaps we have been woefully misled, but we seem to remember a few years ago the manufacturers' argument that power costs were such an insignificant proportion of the total that the introduction of electric driving with a view to their reduction was not worth while.

This attitude is, indeed, so generally understood, that there is a disposition to avoid the question of costs of electrical driving, which, even if higher, would not materially affect the case for the electrical drive, because the possibility of obtaining from 5 to 10 per cent. greater output, with an improved product thrown in, altogether outweighs any small increase, if such should take place, in power costs. We need not here discuss the reasons for this result; they are well known, and have been proved in practice the world over, though many mill owners are still sceptical.

What we fear our contemporary does not appreciate is that the case for electric driving *with purchased power*, strong as it has been in the past, will be rendered practically impregnable by the disproportionate effect of increasing fuel charges on the "well-established steam boiler and highly-developed mill engine" or the "gas-power plant with by-product recovery apparatus, or the newly-established oil engine" as compared with that on the modern public supply station, with its relatively less costly and more efficient plant, advantages in diversity of demand, and ever-growing output, which tend all along to neutralise increasing fuel costs.

The striking feature of electrical production costs in the past has been their continual decrease, particularly in industrial areas, and despite the gradually increasing cost of fuel in pre-war times; the war has simply accelerated the rate of increase of fuel costs, to such an extent as to more than neutralise, for the time being, the normal reduction of average costs due to expansion of business, introduction of more efficient plant, &c., and as a natural result prices have risen, in many instances, though not necessarily permanently. Given a return to settled conditions, even with fuel at present prices, we see no reason why, with an expanding business and modern methods, production costs should not com-

mence to fall again as in the past, and reach a lower than pre-war level.

Surmise would be turned into certainty given the whole-hearted co-operation of the Lancashire mill owners; indeed, it is with a view to ensuring that an ample supply of cheap electricity shall be available to meet their prospective requirements that the recent proposals of the Committee for the Interconnection of the Lancashire and Cheshire Electricity Supply Systems have been put forward. It is not stretching the matter too far to say that the best private plant will be at a discount when the schemes for electricity supply on a wholesale scale at present under consideration mature; the North-East Coast may be cited as an example of intensive electrical development, but Lancashire offers even greater opportunities for electricity supply.

Industrial Reconstruction.

In our issue of July 6th we gave a cordial welcome to the interim report on "joint standing industrial councils" by the sub-committee on relations between employers and employed, of which Mr. J. H. Whitley is chairman. We are glad to see that the desire of the sub-committee that this report should be discussed without delay has been fulfilled to some extent already. Last week we summarised the views of the Employers' Parliamentary Council, which took the form of friendly criticism of the proposals put forward, and an expression of hope that the recommendations of the Sub-Committee would be of assistance in arriving at a true and lasting solution of the problem of industrial reconstruction; this week we are enabled to reproduce a memorandum of the Executive Council of the Federation of British Industries on the subject, produced in compliance with a request from the Ministry of Labour, which claims to be the first authoritative public pronouncement by employers on this important question. From a perusal of this valuable statement it will be seen that the Federation, which is by far the largest and most representative body of employers in the country, and embraces an extremely wide variety of manufacturing and producing interests, is heartily in accord with the general principles which underlie the recommendations, and that its comments mainly relate to the details of the proposed organisation, the necessity of which is amply emphasised; the Federation is not content with mere criticism, it proceeds to discuss the composition and functions of the respective councils, and submits a plan carrying the scheme a stage further, in that it provides a fourth link in the chain, a "National Industrial Council" consisting of representatives of employers and employed in all industries, and forming a final Court of Appeal to which all questions which could not be settled in the sectional councils would be referred. This proposition appears to us admirably to crystallise and define the fundamental ideas embodied in the conclusions arrived at by the Whitley Committee. At first sight the plan would seem to suggest that the Federation was somewhat obsessed with the idea of settlement of disputes, which appears in the forefront of the "duties" allotted to each class of council, and it must be admitted that in the light of past experience this would unfortunately be one of their most important functions; but an examination of the memorandum itself shows that the Federation regards the provision of facilities for co-operative action as of still greater moment, and agrees that harmonious relations between employers and employed are absolutely essential to the attainment of that efficiency of production upon which our commercial prosperity in the future will wholly depend. The importance of securing efficient management in every branch of industrial activity, and of giving it free play in development, is also clearly recognised.

It will be observed, on comparing this memorandum with that which we abstracted last week, that while the latter saw many lions in the path, the former courageously faces the admitted difficulties, and cordially endorses the view of the Sub-Committee that the organisation of every trade is a first essential to their solution; at the same time, it is urged that such organisation must be voluntary, and unfettered by Government control in any form.

So far all goes well; but once more the question to which we have previously referred inevitably crops up: how will it be ensured that the agreements drawn up by these Councils, or other organisations, will be loyally carried out? The problem should not prove insoluble; pending its solution, we are glad to see that the movement towards organisation is making such satisfactory progress.

Reform in Education.

The views enunciated recently by the Senate of the University of London, taken in conjunction with the report of the Committee appointed by the Treasury to consider the scheme of examination for Class I of the Civil Service, afford good grounds for hoping that the reforms so long demanded, besought, and advocated by our most eminent educational authorities are at last about to attain fulfilment. The memorandum of the Senate is uncompromising; the University of London has long held broad and enlightened views on the question at issue, and in this statement the Senate cuts at the roots of the evils which so long have hampered intellectual progress and development in this country, and have contributed so largely to the inception and the prolongation of the war. Had those in chief authority during the past 10 or 20 years been endowed with a well-organised and adequate training for their posts, instead of the narrow and lop-sided curriculum that was forced upon them, we should either have been spared the horrors of world-war or we should long ago have emerged from it victorious.

The Committee is not so downright in its condemnation of the methods of the past, but nevertheless its conclusions may be accepted as highly satisfactory. We do not wish to see classical studies suppressed, or even subordinated to science; what we claim is that the balance should be held justly, and that a due proportion of time should be spent by every student on the study of the world in which he lives and is to work. The revised scheme places modern languages on an equality with the dead languages, gives prominence to the study of English and general knowledge, includes a *viva voce* examination to test mental activity, and gives due weight to mathematics, science, and (a new subject!) engineering. All this is very good, and we trust that the proposals will be carried into effect without serious modification.

In this connection, we wish to draw attention to a small book, entitled "The Public School System in relation to the coming conflict for national supremacy," by Mr. V. Seymour Bryant—a Master of Arts who recognises that increased attention to science in education is indispensable to the training of the mind, and in this work lays bare the defects of our present system, indicating also the steps required to make it more efficient, so that, as Lord Rayleigh says in the preface, "the next generation of English public school boys will have more to show for their time spent in school than could be claimed for ours."

V.B. CABLE BREAKDOWNS IN THE TROPICS.

By D. M. W. HUTCHISON, B.Sc., M.I.E.E.

These few notes are being written in the hope that readers at home and abroad may give their experiences in similar cases to those about to be mentioned.

It is evident that if the cause of these breakdowns can be traced it will be far easier to prescribe a remedy. V.B. cable breakdowns are nearly always put down by the makers to decentralisation of the cores due to overload, but the opinion of those operating these cable systems is by no means unanimous on this point.

The writer has had personal experience of the breakdown of a complete network of V.B. cables, which had ultimately to be replaced entirely, and quite recently there came under his notice a case of breakdown of V.B. shaft cables in a tin mine; both of these cases occurred in the Tropics. Other cases of V.B. cable breakdown have also occurred in the Tropics within the writer's knowledge.

In the first case mentioned, 3-core jute-insulated V.B. cables—mostly ·05, ·025, ·05, but some twice and four times the capacity—were laid solid in bitumen; there can be no doubt in this case that the cables were the best obtainable of their class, and that the laying was done carefully, as the cables were manufactured by a leading firm and laid under the supervision of their own engineer.

The fact remains that within five years of the network being put into commission it was necessary to order new cables, which replaced the original V.B. network two years later; the present cables are lead-covered, paper-insulated, and are giving satisfaction.

In this system there can at first have been no question of overload, although, when faults began to develop, it became necessary to overload parts of the network to continue the supply.

The faults were nearly all of the same type, and occurred in the cable itself; faults in joint-boxes were extremely rare. The fault when dug up was invariably found to be a short-circuit between cores, and there was, as a rule, no leakage to earth; in many cases it was evident that the fault had been developing for weeks, as the cores had almost disappeared, and the bitumen sheathing for several feet on each side of the fault was soft and sticky. A trial length of paper-insulated V.B.-sheathed cable gave better results, but developed trouble at a joint-box.

In the second case mentioned the cables were of the solid V.B. type double-wire-armoured, and supplied pumps in a mine; the cables ran in on the adit level and then passed down a vertical shaft to a depth of about 400 ft., being supported by slings and cleats. The work was supervised by an experienced engineer. Within about three years faults developed of the same nature as indicated above, the cores coming together and short-circuiting; these faults occurred both in the shaft and in the adit level.

In the writer's opinion, V.B. cables are quite unsuitable for tropical countries; taking the F.M.S., where he has had a good deal of experience, there is a regular day temperature in the shade of close on 90° F., and the temperature in the underground workings of a mine may be 110° F. or so. Possibly a good deal of the damage is done in handling the cables; it is, as a rule, impossible to get them in position without exposing them to the heat of the sun, and this may mean a temperature of 160° F., sufficient to soften the bitumen.

There is an idea very prevalent at home that lead-covered cables should be avoided in the Tropics, as there is a difficulty in obtaining skilled labour for jointing; this has been true in the past to a great extent, but has been got over largely by the help of European jointers who have imparted their art to Oriental mechanics.

In the town where the writer resides, plumbed joints are made regularly and successfully by Chinese jointers, trained locally, who also make lead fittings for the purpose.

In the writer's opinion, lead-covered paper-insulated cable takes a lot of beating, and as it can carry a lot more current for the same area of copper than other types without damage, it is especially suitable for mining purposes where it may be necessary on occasions to overload plant and cables to cope with an emergency. For special positions, such as shafts in a mine where acid water is encountered, a double-wire-armoured cable protected by a bitumen sheath over-all, and with solid strand filling, should meet every requirement and should give no trouble once properly installed. The possibility of the lead parting under the strain of its own weight might be avoided by specially careful manufacture, and by the use of fairly short lengths looped in to horizontal joint-boxes in chambers excavated in the sides of the mine shaft. Cables with varnished cambric insulation, which are used largely in America, might also solve the problem, as this class of insulation is said to be non-hygroscopic and is mechanically strong.

FAULT LOCALISATION BY DROP OF POTENTIAL.

By H. E. BLAKE, A.M.I.E.E.

A previous article on "Induction Methods of Fault Localisation" has elicited so many interesting comments and inquiries, that the writer is encouraged to ventilate the subject of drop-of-potential methods in the hope of a similar fruitful result. A comparison of notes by those engaged in the practical work of the distribution of electricity should be of the greatest benefit to the industry.

In utilising the drop-of-potential method, the ideal conditions for success are indicated by the following diagram:—

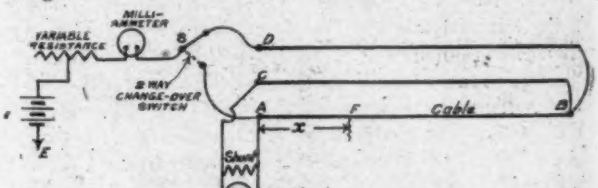


Fig. 1.

Obtain suitable readings on G by adjusting the resistance

Then $x = l \times d_1 c_2 / (d_1 c_2 + d_2 c_1)$.

x = distance of fault from A,
d_1 = galvo. deflection with S to A
d_2 = " " S to D
c_1 = milliamperes with S to A
c_2 = " " S to D
Without altering galvo., shunt, or variable resistance.
l = length A B.

It will be noted that with two sound lines available between the ends of the faulty cable, it is unnecessary to know their length or sectional area, because, with the two-way change-over switch S to D, the drop is measured by G between F and B only, A F and C B automatically becoming extensions of the galvanometer leads. Similarly with S to A, the drop is then measured from A to F only, C B F becoming an extension of the galvanometer lead to C. The result eliminates all errors except those of contact resistance, which can be guarded against by clean connections, and those due to the slight difference in length between the inner and outer conductors of a concentric system, owing to the bridging of the outers, where the cable has been cut for services. The errors entirely eliminated by this method of connection are:—

1. *Due to fault resistance.* This may be high, low, or varying, without vitiating the test. In the case of a steady resistance, either high or low, deliberate readings may be taken on the galvanometer, as the drop is measured before the current passes to earth. In the case of a variable resistance, rapid readings should be taken, three or four times in succession, by means of the change-over switch, thus counteracting the error due to this cause.

2. *Due to the loop at the far end* B. By connecting as shown, no loop need be allowed for, as the measurements are taken on the faulty cable only, the loop merely forming part of the galvanometer leads.

3. *Due to the cable connections to the apparatus.* By connecting the galvanometer direct to the cable under test, as shown, this error is entirely removed. This constitutes a great advantage for this method over the Murray or Varley loop tests.

These ideal conditions for the use of this test most frequently arise on D.C. three-wire systems, where the negative conductor has developed its habitual fault due to osmosis, and the positive and neutral conductors remain sound; but faults on short lengths of distributor under the worst conditions of shorting may be localised by this method, by laying a length of twin cab-tire-sheathed cable in the gutter to represent the two testing lines.

The numerous adaptations of the drop-of-potential method of fault localisation for the infinite variety of conditions that arise in practice, after the fault has been analysed by megger testing from both ends, would require too long a demonstration. Suffice it to say that when only one sound line is available, the sectional area of lead and return must then, of course, be considered, and the loop at the far end allowed for. The writer has achieved highly-successful results by this method with a Paul Unipivot galvanometer of 50 ohms resistance and a scale range of 50 divisions each side of a central zero. The current to actuate this instrument is so small, that very careful milliampere readings are necessary to obtain an entirely accurate result on short lengths. The battery used was one of 4 volts, 20 ampere-hours, the variable resistance 0 to 2,000 ohms, and the galvanometer shunt resistance $\frac{1}{1}$, $\frac{1}{5}$ and $\frac{1}{50}$ of the instrument. An induction test with a telephone and search-coil should be made after the drop-of-potential test, to check the position of the fault, should it happen to be on a service, as the drop-of-potential test will only show the position accurately if it is on the straight run. A drop-of-potential test, however, saves walking over the whole of a long route with a search-coil.

With reference to variable fault resistances, where time allows of it, the faulty cable should always be broken down to earth before starting the test, in order to avoid this source of error entirely. If the fault resistance varies rapidly, the change-over switch is not quick enough to obtain two galvanometer readings with the same resistance in the whole circuit. In cases where a cable has shorted and sealed itself again (not an uncommon event on H.T. supply, especially where diatrine or similar insulation is used), only the outer conductor should be broken down to earth, as the inner may then be used as one of the sound testing lines. When using high pressure to break down cables to earth, which have re-sealed themselves, the desired result will be obtained more rapidly by raising the pressure gradually through a liquid resistance. If the high pressure is switched on instantaneously, it will merely blow its fuse at the moment it sparks through the insulation, which will re-seal itself again and again.

A breakdown on a feeder is often heralded by preliminary intermittent shorts a day or two before the event. These shorts are usually instantaneous, and it is impossible to localise them to a single feeder area, where no maximum pointers or relays are fixed in connection with the feeder ammeters at the generating station.

The following simple method, which has the important recommendation of economy in these days, will localise the trouble to one area, which can then be inspected and tested. A loop of tissue paper $\frac{1}{16}$ in. wide, in the shape of the upper half of a clamp connection, should be stuck across the scale on the face of each feeder ammeter—say, 30 amperes above maximum load. This will be severed or moved by the swing of the ammeter needle, and the feeder affected will thus be indicated.

With regard to the causes of faults on three-wire V.R. single cables D.C. laid solid in wood troughing, moisture is often first introduced by the pine knots in the cover of the troughing letting out their turpentine under the influence of damp and varying temperature, thus acting as a solvent on the bitumen beneath. There is a considerable deposit of turpentine in a pine knot, which is a hardening of the sap where the tree has branched.

When locating faults on A.C. concentric L.T. systems, the fact must be remembered that this system acts as a condenser, giving a high reading in volts from inner to earth, with sound insulation. A fault dead to earth, on inner or outer, will bring the volts to zero of the affected winding, when measured to earth, and the volts between the unaffected winding and earth will rise to the same pressure as that between inner and outer. This should be borne in mind, in order to distinguish normal condenser effect from faults. The following results are of interest as an example of what may be expected under working conditions on a network clear of earths, without disconnecting consumers' wiring:—

Size and type of cable.	Insulation.	Length.	Volts.			Remarks.
			I to E.	O to E.	I to O.	
0·1 sq. in. concentric, paper-insulated, lead-covered.	0·5 Ω	4 yards	0	0	210	Drawn in iron pipes to this point.
	50,000 ω	325 „	100	76	210	
	50,000 ω	525 „	108	72	210	Laid solid in earthenware to end.
	20,000 ω	682 „	126	72	210	

THE EXAMINATION OF COMMUTATION CONDITIONS IN INTERPOLE MACHINES.

By FREDERICK MURGATROYD, B.Sc. Tech.

The introduction of interpole machines simplified enormously the practical problems of commutation by establishing a constant brush position. To maintain a constant brush position it is necessary to have a fixed neutral at all loads. This, obviously, may be attained by providing—

(*a*) A flux equal in magnitude and opposite in direction to the armature reaction flux.

(*b*) A flux strong enough to neutralise the reactance flux existing in the coils undergoing commutation.

Both these functions the interpole is able to perform, with the result that a machine fitted with interpoles has many substantial advantages over the non-interpole machine. The necessary field ampere-turns are lowered, flux densities are reduced, higher peripheral speeds are made possible, brush thicknesses may be increased without excessive circulating currents resulting, higher ratings are made possible for the same frame, and sparkless commutation is obtained much more easily.

It is thus seen that in the running of interpole machines the engineer is primarily concerned with two factors, namely:—

(*a*) Maintaining the correct brush position.

(*b*) Maintaining the correct interpole field strength.

The object of this article is to discuss the methods by means of which these factors may be correctly ascertained.

Brush Position.—As stated above, the correct brush position for interpole machines is the neutral axis. There are several good methods of ascertaining this neutral position, but by far the best is the "kick" method. This consists in alternately switching the field "on" and "off," and in taking millivoltmeter readings, the ends of the instrument leads being held firmly on successive pairs of commutator segments which are a full pole-pitch apart. The armature must be kept stationary, of course, and all brushes must be lifted. The positions of the segments between which the millivoltmeter reading is zero, are the positions of two adjacent neutral points. A check test should be made by rotating the armature slightly so as to make the relative positions of armature slots and pole pieces different, and the above procedure should be repeated. If the second neutral point is different from that obtained by the first test, the mean of the two determinations should be chosen as the true one. However, if the machine is a generator, it may be more convenient to run it up to speed by means of its motor or prime mover, with brushes lifted and field excited. Then, if the ends of the millivoltmeter leads be placed at various points on the commutator near one of the neutral axes, the ends themselves

being as close together as possible, the point at which the reading on the voltmeter is zero is the true neutral. The neutral point having thus been found, the brushes should be carefully set, so that their centre lines coincide with this neutral axis. The brush spacing should then be checked up, and the brushes rebedded to the commutator, if necessary, before starting up.

Commutation.—The actual disposition of current in the brush is a very complicated phenomenon. However, ideal commutation is quite a simple action, and as it is towards this ideal that we are always working, it is perhaps necessary that we should now state what this is. By "straight-line" or "ideal" commutation, we mean that, as any one coil becomes short-circuited by the brush at A (fig. 1), the current in the coil should begin to die away uniformly, until at the midway point B the coil carries no current. The current should then build up uniformly, until at the point C, where the coil becomes open-circuited again, it should be carrying its maximum current as at A, but in the opposite direction. When this condition is not fulfilled, there is an abrupt change of current in the coil when it open-circuits at C, and sparking ensues. Now this ideal commutation cannot be attained if the self-induction of the coil is not adequately compensated for by providing the correct number of extra ampere-turns on the interpole, the result being that the energy stored up in the coil has to be dissipated by a circulating current which passes through the coil and brush, destroying all the conditions necessary for ideal commutation. It may be taken as an axiom that, given good mechanical conditions, sparking in interpole machines is always due to these unbalanced circulating currents, and therefore to an incorrect interpole field strength. It is patent, therefore, that to be able to test for circulating currents is an absolute necessity, and this may easily be done by means of brush-volt curves.

Brush-volt Curves.—The brush-volt curve is a curve showing the variation in contact drop between brush and commutator throughout the brush thickness. It is obtained in the following manner:—Mark along the brush thickness a number of equidistant points as shown in fig. 2. For a ¾-in. brush, ⅛-in. divisions are very suitable, and give seven readings. Readings are then taken whilst the machine is

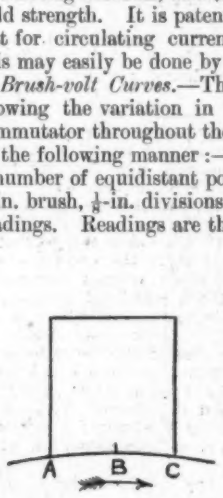


Fig. 1.

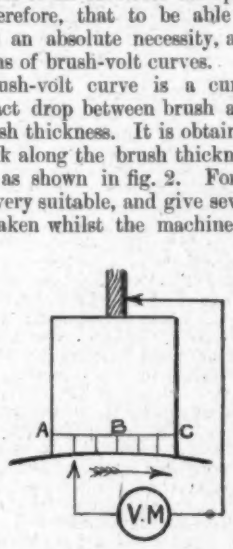


Fig. 2.

on load, by connecting a millivoltmeter between the top of the brush and points on the commutator immediately under each of the divisions of the brush in turn. It is very important to agree upon one standard method of connecting up the voltmeter, and the usual practice is to take the readings at the + brush in a motor and the − in a generator, the + of the voltmeter being connected to the brush and the − to the commutator. It is also advisable to standardise the direction of rotation, say, clockwise. The terminal of the + lead of the voltmeter may be a copper hook which is easily attached to, and detached from, the brush flexible. The − lead should terminate in a thick copper wire pointed at the end. The curve is constructed by plotting as ordinates the readings on the voltmeter, and as abscissæ the corresponding points along the brush thickness.

Diagnosis of Commutation Conditions from the Brush-volt Curve.—Let us first assume that we have ideal commutation. Although each individual coil whilst shorted by the brush reverses its current from maximum in one direction, through zero, to maximum in the other direction, the current collected by the brush itself is quite constant, and under a condition of ideal commutation the current density is the same at every point on the contact surface. Thus the contact drop is uniform, and ideal commutation may therefore be represented by the straight line shown in fig. 3*a*. Circulating currents upset this uniform current density, so that the straight line becomes inclined and curved. The five curves in fig. 3 illustrate typical results. Fig. 3*a* shows a condition of ideal commutation, as already described. Fig. 3*b* shows the curve obtained with a weak interpole, which, by retarding commutation, produces an excessive current density at the toe of the brush, and, as a general rule, sparking. The contact drop varies approximately as the

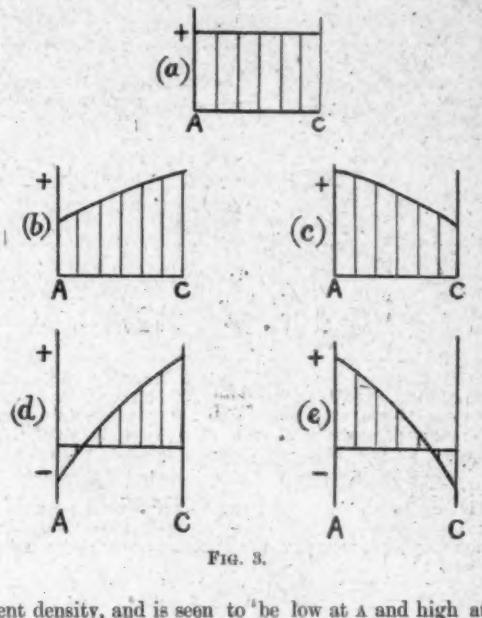


Fig. 3.

current density, and is seen to be low at A and high at C. Fig. 3*c* is the reverse of the above, and shows the curve obtained with a strong interpole field, which has the effect of hastening commutation, and thus producing a low current density at the toe, thereby lessening any tendency to spark. Fig. 3*d* shows the effect of a reversed interpole field, which would, of course, lead to vicious sparking, and fig. 3*e*, the effect of an excessive increase in the interpole field strength. The curves do not indicate the absolute current density at a point on the brush, because the current density is continually varying at any one point, so that the reading on the voltmeter is merely the average contact drop. Still, they do indicate the nature of the commutation conditions the brush is being called upon to withstand, and give a true indication as to whether the interpole flux is correctly adjusted, and if not, how it should be changed to produce a condition nearer to that of ideal commutation.

THE PRODUCTION AND DISTRIBUTION OF POWER, AND ITS INFLUENCE ON THE DEVELOPMENT OF IRISH INDUSTRY.

By J. F. Crowley, D.Sc.

(*Abstract of paper read before the* Irish Technical Congress, Dublin.)

Notwithstanding the many sources of power apparently open to us, over 90 per cent. of the power used in industry in the United Kingdom comes from reciprocating steam engines or steam turbines using coal as a prime source, and less than 10 per cent. is derived from all other sources. Coal, therefore, is our principal source of power, and it is important to inquire how we stand with regard to our supplies of it.

In 1905 it was estimated that "the available quantity of coal in the proved coalfields of the United Kingdom was 100,914,668,167 tons, and in the unproved coalfields 39,483,000,000 tons, at depths of less than 4,000 ft. in both cases, while the total figures for available coal in Ireland were given as 174,458,000 tons.

The amount of coal raised in the United Kingdom in 1903 was 230,334,469 tons. The average yearly output for Ireland between the years 1880 and 1902 was 115,500 tons, and for the past 12

years only 86,000 tons, with average yearly imports during the same period of 4,574,234 tons. Of the total coal raised annually in the United Kingdom, 63,805,000 tons are exported in one form or another, the remainder being consumed at home. Apparently, then, if we ignore the needs of future generations we can continue to use coal at our present rate for very a considerable time without any fear of exhausting our supplies.

There is another side to this matter, however. While our supplies of coal are very great, we cannot go on increasing our yearly output indefinitely, and the price of coal at the pit mouth is steadily advancing, while, on the other hand, our need of this important commodity is steadily growing. We must, therefore, seek some method of economising in the use of coal employed for power purposes, and may consider the following possible methods :—

(*a*) A reduction in the amount of power used for industrial purposes.
(*b*) The development of alternative sources of power.
(*c*) Economy in the methods of producing, transmitting, distributing, and applying power.

In considering whether it is practicable to reduce the amount of power used in industry, the following table compiled from figures given in the Census of Production (1907) Report should be of interest :—

—	Excess of value of work done over cost of materials used in pounds.	Number of operatives employed.	Engines owned. Total H.P.	Net output per operative employed.	H.P. per operative employed.
England and Wales ...	602,994,000	5,808,269	9,097,869	104	1·56
Scotland ...	86,364,000	885,403	1,397,733	98	1·57
Ireland ...	22,777,000	291,304	259,407	78	·88

Column 1 gives the value of the total output of all the industries of the United Kingdom covered by the Census of Production, less the value of the raw materials purchased and the amount paid to other firms for work given out. This value is called the "net output," and is a figure of considerable value, as it gives without duplication the value added to the raw materials during manufacture.

Column 4 gives the "net output" per operative per annum, and *judiciously employed* is a figure of the greatest importance for comparing the efficiencies of various industries or groups of industries.

In a paper read in Manchester in 1912 I expressed the relation between the various quantities above referred to algebraically, as under :—

If M = the value in pounds of one year's raw material,
S = the " " " " output,
N = the number of operatives, and
K_1 = a constant for a particular industry or group of industries,

Then— $$M + K_1 N = S. \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

For the industries of the United Kingdom, taken as a whole, the constant K_1 has a value of 102.

Still following the method of treatment developed in the paper referred to, and since the "net output" has to provide all wages, standing charges and profits, we have—

If P = profits in pounds per operative per annum,
C = cost of power " " " "
R = rent, rates and taxes, maintenance, interest and depreciation in pounds per operative per annum,
W = the wages in pounds per operative per annum,

$$P + C + R + W = K_1. \quad \ldots \quad \ldots \quad (2)$$

From the Board of Trade Reports on Earnings and Hours of Labour we obtain the average wages of all operatives in a given industry, and we thus obtain the value of W, which enables us to re-write (2) thus :—

$$P + C + R = K_2. \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

The following table, which gives the values of certain of the above figures for industries which are of special importance to Ireland, may be of interest :—

—	H.P. per operative.	K_1.	W.	K_2.
Lace	·28	98	£54·5	£43·5
Cotton	2·16	79	48·0	31·0
Wool and worsted, carpet, flock and shoddy	1·23	70	40·0	30·0
Elastic webbing	·36	68	37·0	31·0
Hosiery	·15	61	38·5	22·5
Silk	·58	55	34·5	20·5
Linen, jute and hemp (spinning and weaving)	1·09	61	31·5	29·5
Bleaching, dyeing, finishing, and printing of textile goods	1·83	101	54·5	46·5

As already pointed out, it is usual to take the values of K_1 for different industries, as indicating to some extent their efficiency as competing entities; I would suggest that K_2, a figure that is available for all countries for which K_1 can be obtained, forms a better basis for comparing industries as trading bodies abroad, since high wages, while they increase the value of K_1, have an adverse effect on ability to compete.

The only really practical test, however, is the price at which competitive articles are placed on a suitably chosen neutral market.

By a work first published in 1916, public attention was focussed on the fact that in comparing two similar trades in different countries, a high value of K_1 is almost invariably associated with a high horse-power per operative. The horse-power per operative for England, Scotland, and Ireland at the time of the last Census of Production, as given in a previous table, was 1·56, 1·57, and 0·88 respectively, the corresponding figures for K_1 being 104, 98, and 78. If we turn to America, we find figures for K_1 varying over a wide range of industries between one and a-half and three times as great as those for the United Kingdom with the horse-power per operative between one and a-half and six times as great.

It should be clear, then, that if wages are to improve and capitalists to receive an increased return on their investments, both essential to the advancement of industry, an increased amount of power must be introduced into industry; and instead of being able to effect coal economies in this direction, we must be prepared to meet fresh demands on our resources.

We may now consider our second alternative—viz., the development of other sources of power. First, as regards peat; the principal problems to be solved if peat is to be successfully used on a large scale for power purposes, are :—

(*a*) The securing of rights over an area of bog containing peat with a suitable nitrogen content, and sufficiently large to provide power for a period long enough to justify the capital expenditure involved. This may be difficult in some cases owing to vested interests and the existing turbary rights of small holders.
(*b*) The development of a suitable method of "winning" peat on a large scale from the bog.
(*c*) A commercial process for the removal of surplus water from the required quantity of peat.

Granted the provision of a continuous supply at a sufficiently low cost of peat with a water content not much exceeding, say, 50 per cent., it may at once be said that there are no unsurmountable *engineering* difficulties to prevent peat being used on a large scale as a substitute for coal for the production of power, in gas engines for small and medium powers, and preferably in steam engines for large powers.

Oil may form a substitute for coal to a certain extent, provided the supply can be made more reliable, and the price per ton brought down to a sufficiently low figure, and kept out of the realm of speculation.

It may be interesting to note in passing that the largest oil engine so far built is a two-cycle single-acting Diesel engine, completed during the present war to the order of Messrs. Harland and Wolff, of Belfast. This engine was built in Switzerland for an output of 3,750 H.P., and gave 4,500 H.P. on the test bed.

The only source of power other than peat that we need seriously consider in this country as a substitute for coal is water. The Coal Commissioners (1905), in dealing with this matter, suggest that it is desirable to examine into the capabilities of the water powers in Ireland, as small sources of power might be used economically where there is little or no competition with coal. There is no doubt that it is eminently desirable that the investigation suggested by the Commissioners should be carried out. Matters for consideration in connection with the development of water power in this country are existing and future navigation and fishery rights, and the peculiar geological formation of the country, which raises important questions with regard to drainage. It should not be overlooked that the capital cost of a scheme for developing power from water is almost always much higher than the cost of a corresponding steam plant.

Altogether I think it may be said that for the United Kingdom, as a whole, no new facts have arisen since the Royal Commissioners' Report, to which reference has been made, to alter the conclusion they arrived at—viz., that "coal is our only reliable source of power, and there is no real substitute." With regard to Ireland, however, the bulk of the coal consumed is sea-borne; its cost is consequently higher than in Great Britain, and a very strong case can be made for a careful and systematic investigation of Irish resources in coal, peat, and water power, and of the best methods of utilising these for the development and distribution of power.

The production of power from large power units in central power stations is incomparably more economical in coal consumption per horse-power than the present method of production in small scattered plants, and the decrease in coal consumption with size of generating unit continues far beyond the largest size unit so far built. Further, the *cost* of power produced falls off even more rapidly with the size of generating unit than does the consumption of fuel. It may be of interest to note, in passing, that the Germans claim to be building just now the world's largest single electrical unit, of an output of 60,000 K.V.A., or at a power factor of 0·8, approximately 65,000 electrical H.P. I mention this advisedly, as it shows that the Germans are working on the same lines as we are with regard to the economical generation of power.

The production and distribution throughout suitably chosen areas of economic size of power in bulk from large suitably situated central power stations would, at a conservative figure, save us 50 per cent. of our present coal bill for power purposes, and effect a still greater percentage saving in the cost of the power generated.

Power engineers generally are agreed that the steam turbine is the most suitable prime mover to produce power on a large scale, and electricity the most suitable agent to distribute it. The steam required can be raised from coal, fired in the ordinary way, coal-

dust, producer gas made from coal, waste gases of any kind as coke oven, blast furnace gas, &c., natural gas, water gas, peat fired directly under boilers, peat powder alone, or mixed with coal, producer gas made from peat, &c, or from oil. There are many points in favour of factory owners taking bulk electrical supply from central generating stations, and many well-known advantages in driving the machinery electrically.

Any advantages claimed for electric driving generally can be claimed for individual electric driving also; while, in addition, special advantages can be obtained with this drive in certain cases, such as :—(1) Saving in the power consumed; (2) increased production due to (*a*) peculiar advantages in the case of certain machines, resulting, in some cases, in an increase in production varying from 10 to 25 per cent.; (*b*) better supervision, &c.

General opinions such as have to be expressed in a paper such as this are naturally subject to revision based on developments in engineering or increases in the cost of power; Belfast may, one day, for instance, receive its power electrically from the coal-fields of Scotland, but I do not see any reason to anticipate any substantial revision in the immediate future.

I have endeavoured in the short time at my disposal to show that coal is our main source of power, that there is reason to fear that supply will not always keep pace with demand, that the price will steadily advance, and that in our endeavour to economise in its use and at the same time provide cheap power for our industries we would do well to consider the use of peat and of water as alternative sources of power. Further, considerable economies can be effected by producing power in bulk in central stations, transmitting it electrically to the industrial centres of the country and distributing it to consumers, both large and small.

STEEL TROLLEY WIRE.

In an article in the *Electric Railway Journal*, S. H. Anderson describes the successful use of steel trolley wire on the Pacific Electric Railway.

The company put up its first steel trolley wire in February, 1910, with a view to testing its value against copper costing 15 cents a lb.; now copper is valued at 40 cents and steel costs 12 cents a lb., and since 1910 the company has gradually extended its use until about 100 miles of No. 0000 double-grooved Roebling steel wire has been erected. The first steel trolley wire was for 600-volt direct suspension, and was butt-welded and ungalvanised. Galvanised wire was then adopted to prevent corrosion, and a lap-welded braze superseded the butt joint on account of the wire parting at the factory splices. This eliminated most of the trouble, but it was necessary to provide an oxy-acetylene welding outfit to weld the wire on site when breaks occurred. Seven years' service on a line with a 3 or 4-minute service during rush hours, shows the wire to be in first-class condition as a whole. It has a smooth under surface, and no signs of wear at clips, switch points, or splices, contrary to the condition of copper trolley wire.

Since the copper and splice at the ends of the steel wire has been renewed twice since 1910, and as the steel is good for four or five years more, the life of the steel on tangents should be three or four times that of copper. At accelerating or feeding points, however, steel is not expected to last longer than copper, if as long. In 1912, some 4,800 ft. of steel wire was installed on a high-speed catenary line with a 3 or 4-car train service. Inspection shows 13 per cent. wear on tangents, and 22 per cent. at clips of hangers; future life estimated at 3 years. On curves the wear is 22 per cent. on the run and 29 per cent. at clips; future life estimate, 2 years. About 500 ft. of tangent was renewed this year, owing to wear due to heavy arcing at accelerating points, the wear being as great, or greater, than with copper.

The most important installation is on a stretch of line operated at 60 to 70 M.P.H. on 1,200 volts, where the smaller current induces less burning than on the 600-volt lines.

It is not found that trolley wheels wear out faster under steel, but it is surmised that the pneumatic trolley bases, which keep a constant upward pressure, may be the reason.

A larger number of feed-in points are required; on the San Bernardino line, with a copper circuit and steel messenger in parallel with the trolley, the feed-ins are 450 ft. apart. For direct suspension, a feed-in at every other pole—that is, 220 ft. apart—is being gradually adopted.

Generally speaking, the maintenance on steel trolley wire is far below that on copper; the steel is harder, the clips hold better, and the wire does not break if the trolley pole hits a span. No breaks have been due to crystallisation at ears, &c., and where wire has broken and shorted to the rail, it can usually be restrung, whereas copper would become annealed. The steel is easier to pull up, and its wear is almost all due to burning and arcing.

For welding, rods of $\frac{1}{4}$ in. or $\frac{5}{16}$ in. nickel steel are used, the time taken to weld the wire in the air being 10—15 minutes.

Bending tests showed that the wire would stand six right-angle bends in a vice before breaking, and heating tests, by passing current through the wire until red hot, showed that though the galvanising burnt off, the wire was otherwise uninjured. Tests showed the resistance to be ·000342 ohm. per ft. at 100° F., or 6·58 times that of No. 0000 copper under similar conditions; being 10·6 per cent. lighter, its resistance per unit of weight is 5·83 times that of copper.

INDUSTRIAL RECONSTRUCTION.

The following recommendations on the Whitley Report on Industrial Councils have been put forward by the Federation of British Industries, and are referred to in our leading columns to-day :—

1. The Federation cordially endorses the view of the Reconstruction Committee as to the vital importance of securing co-operation between employers and workpeople after the war; it is needless to recapitulate the many difficult problems which are likely to arise, some of which are touched upon in the Report of the Committee, but few can fail to realise the serious consequences to our commercial and national position which may result from failure to secure harmony between employers and employed. Efficiency of production is a prime consideration. For this it is necessary to have co-operation and agreement with labour, who in return will, and are entitled to, demand improved conditions of employment, a higher standard of comfort generally, and opportunity of appreciating the true interests of the trade in which they are engaged.

The complement of efficiency of production is efficiency of management, whether in the organisation of works and of business, in inventiveness, or in the study and capture of world-wide markets. Such management is at the base of an intensive demand for labour, and must be guided and controlled by the best individual brains of the country. Care must therefore be taken not to interfere with their work, but to afford them the fullest scope, for without an intensive demand for labour it is hard to see how the best conditions can obtain. Any scheme for reconstruction must therefore have regard to the importance of efficiency, both in business and productive methods and in commercial management, and nothing in the suggested Councils should tend to impair or interfere with development in this direction.

2. The Federation cordially welcomes the views expressed by the Committee as to the important part which must be played by Associations in the settlement of these difficult questions, and expresses the opinion that it is indeed only by the establishment in each trade of organisations representative of employers and workpeople respectively that the object can be achieved.

The Federation, therefore, would lay particular emphasis upon the views expressed in Paragraph 23 of the Report :—

> "It may be desirable to state here our considered opinion that an essential condition of securing a permanent improvement in the relations between employers and employed is that there should be adequate organisation on the part of both employers and workpeople. The proposals outlined for joint co-operation throughout the several industries depend for their ultimate success upon there being such organisation on both sides; and such organisation is necessary also to provide means whereby the arrangements and agreements made for the industry may be effectively carried out."

While agreements in the fullest sense can only be made between organisations representing each side, it is almost impossible to provide security for such agreements if any appreciable portion of workpeople on the one side, or manufacturers on the other, are not members of their respective organisations, and are consequently not bound by the agreements.

In the opinion of the Federation this point is so important that they suggest that the Government ought to go far to recognise, and give an official standing to, organisations representative of employers and workpeople respectively, and to encourage the development of such organisations.

3. The recommendations of the Committee are far-reaching and important, but it will be readily admitted that the construction of an organisation on the lines suggested is a delicate matter, and the Federation notes with satisfaction that in the creation of the proposed organisation it is not contemplated that the Government shall actively interfere. The Federation desires to emphasise this point, and to urge that while sympathetic Government assistance may be, and doubtless will be, of great value, it is most important that there should be no suggestion whatever of Government pressure or coercion, and that each trade shall be free to build up its own organisation voluntarily and on lines best suited to its peculiar needs.

4. It may be pointed out that the descriptions in the Report of the various Councils are somewhat vague and uncertain. The Federation, however, understands that the National Industrial Councils referred to are Councils of individual trades, and not national in the literal sense.

The Federation is of opinion that the basis of the scheme should be Trade Councils of masters and men—that is to say, that each trade or section of an industry should form a Council representative of the employers' organisation or organisations and of the Trade Union or Trade Unions concerned with such particular trade or section of an industry. This Council should have the sole power of dealing with agreements of all kinds and any other matters appropriate to the particular trade or section of industry.

Some difficulty arises in this connection owing to the existence of Unions in certain cases overlapping various different sections of trade. This, however, is a matter of detail which could no doubt be easily overcome.

5. In the opinion of the Federation, devolution of constructive work to District or Works Committees would be very dangerous. It should only be permitted to develop in the light of experience.

6. It is suggested that the main value of District Councils would be to constitute a court of arbitration in the case of any difference between employers and employed in the trade in the district, having regard to the general and any peculiar conditions obtaining in that district.

7. In the opinion of the Federation the Works Committees

should be entirely voluntary in the case of each individual firm, and not in any way officially constituted. They should consist entirely of representatives of the employés, and they should, if possible, be elected by secret ballot. Where instituted their duties should be confined to reporting to, or receiving from, the management complaints regarding breaches of any agreements which may have been made between employers and employed.

8. It appears to the Federation that the general principle underlying these suggested Councils should be the centralisation of policy and the decentralisation of administration.

9. The Federation suggests that while the proposed Trade, or as they are designated in the Report National, Councils, may be well suited for discussing questions peculiar to the trade, and may provide a suitable Court of First Instance for the settlement of disputes, it would be highly desirable that superior bodies should exist, consisting (1) of representatives of employers and employed in each group of trades forming an industry, which might possibly be styled "Councils of Industry," and (2) of representatives of the employers and employed in all industries, which might possibly be styled "The National Industrial Council."

The Councils of Industry and the National Industrial Council would provide suitable Courts of Appeal from the Trade Councils in cases of differences between employers and employed in any trade which cannot be settled by the Trade Council. It is not necessary to suggest exact details of procedure, nor is it intended to interfere in any way with existing Conciliation Boards or other arrangements for settling disputes, but rather to build up similar organisations in industries where they do not at present exist, and only to supplement existing organisations.

The Federation is of opinion that provision of methods for preventing or settling differences is almost as important as provision of facilities for co-operative action, and the Federation is of opinion that if no strike or lock-out could take place until the question had been submitted to final arbitration by a truly National Council of employers and employed, there would be good grounds for hoping that the time for reflection afforded, and the pressure of popular opinion, would ensure the loyal adoption of the award.

10. With regard to the consideration of general questions, amongst which many of the most important are mentioned in paragraph 16 of the Report, the Federation are of opinion that these should be dealt with primarily by the National Industrial Council, which should delegate to the Councils of Industry, and possibly to the Trade Councils, the consideration of matters of peculiar trade interest in such cases as the National Industrial Council may think desirable. The final decision in all matters of general policy should be taken by the National Industrial Council after providing reasonable opportunities of criticism on the part of the Councils of Industry and Trade Councils. Nothing in this suggestion, however, is intended to prevent the Trade Councils or Councils of Industry from initiating the consideration of any matter of general interest.

System of Industrial Councils Recommended by the Federation of British Industries.

National Industrial Council.—Composition.—Representatives of employers and workpeople from all industries.

Duties.—Final Court of Appeal in disputes. Primary body for consideration of questions in Clause 16 of Whitley Report, with powers to allocate specific questions to other Councils. Should take *final* decision in all matters of general policy after giving ample opportunity for discussion and criticism by Councils of Industry and Trade Councils.

Councils of Industry.—Composition.—Representatives of employers and employed in each group of trades forming an industry (such as the textile trades, &c.).

Duties.—To act as a Court of Appeal from the Trade Councils in disputes. To deal with all special matters which may be allocated to them by the National Industrial Council, to initiate consideration of matters of general interest to the particular industry with which they are concerned, and to forward such matters to the National Industrial Council if of general interest, and to consider, and, if necessary, forward to the National Industrial Council any such matter initiated by a Trade Council.

Trade Councils.—Composition.—Representatives of the Employers' Organisation or Organisations, and of the Trade Union, or Trade Unions, concerned with a particular trade or section of an industry.

Duties.—First Court of Appeal in case of disputes. Sole power of dealing with agreements and all other matters pertaining to the particular trade or section, and with any special matters delegated to them by the Council of Industry or by the National Industrial Council.

Works Committees.—Composition.—An elected body of workpeople in each works, to be set up only by the joint consent of the individual employers and employed concerned, their institution to be entirely voluntary.

Duties.—Reporting to, or receiving from, the management complaints regarding any breaches of agreements which may have been made between employers and workpeople.

Electrical Trades Union.—An organising meeting of power and sub-station engineers was to be held by the London District Committee on Wednesday last. All central station and sub-station men were invited to attend and to hear what was being done for the station men. "Join us, and so hasten the day when your Trade Union shall control the electrical industry. Over 600 station men already in our ranks in London branches."

TRADE STATISTICS OF SPAIN.

The figures given below show the imports of electrical and similar goods into Spain during the year 1915, according to the official statistics recently issued. The figures for 1914 are given for purposes of comparison, and notes of increases and decreases (which are very considerable) have been added:—

	1914. Pesetas.	1915. Pesetas.	Inc. or dec. Pesetas.
Arc lamps.—			
From Germany	66,000	9,000	– 57,000
,, France	10,000	2,000	– 8,000
,, Great Britain ...	29,000	2,000	– 27,000
,, Other countries ...	10,000	1,000*	– 9,000
Total	115,000	14,000	– 101,000
* United States.			
Carbons for arc lamps.—			
From Germany	63,000	21,000	– 42,000
,, France	13,000	1,000	– 12,000
,, Great Britain ...	15,000	9,000	– 6,000
,, Other countries ...	2,000	2,000	—
Total	93,000	33,000	– 60,000
Incandescent electric lamps, mounted.—			
From Germany	2,105,000	1,624,000	– 481,000
,, France	48,000	37,000	– 11,000
,, Great Britain ...	47,000	33,000	– 14,000
,, Austria	215,000	—	– 215,000
,, United States ...	—	179,000	+ 179,000
,, Italy	—	122,000	+ 122,000
,, Switzerland	—	246,000	+ 246,000
,, Other countries ...	742,000	179,000	– 563,000
Total	3,157,000	2,420,000	– 737,000
Dynamos, electric motors, induction coils, resistances, transformers, &c., up to 100 kg. weight.—			
From Germany	1,946,000	—	– 1,946,000
,, France	427,000	297,000	– 130,000
,, Great Britain ...	302,000	196,000	– 106,000
,, Holland	5,000	88,000	+ 83,000
,, Italy	160,000	234,000	+ 74,000
,, Norway	—	20,000	+ 20,000
,, Sweden	110,000	61,000	– 49,000
,, Switzerland	46,000	136,000	+ 90,000
,, Other countries ...	472,000	815,000	+ 343,000
Total	3,468,000	1,847,000	– 1,621,000
Ditto, weighing from 101 to 400 kg.—			
From Germany	860,000	266,000	– 594,000
,, United States ...	265,000	27,000	– 238,000
,, France	148,000	96,000	– 52,000
,, Great Britain ...	249,000	163,000	– 86,000
,, Italy	24,000	71,000	+ 47,000
,, Norway	—	52,000	+ 52,000
,, Sweden	244,000	94,000	– 150,000
,, Switzerland	85,000	156,000	+ 71,000
,, Other countries ...	37,000	12,000	– 25,000
Total	1,912,000	937,000	– 1,075,000
Ditto, weighing from 401 to 2,500 kg.—			
From Germany	1,597,000	251,000	– 1,346,000
,, France	333,000	159,000	– 174,000
,, Great Britain ...	399,000	277,000	– 122,000
,, Switzerland	82,000	169,000	+ 87,000
,, United States ...	532,000	46,000	– 486,000
,, Other countries ...	412,000	174,000*	– 238,000
Total	3,355,000	1,076,000	– 2,279,000
* Sweden, 109,000.			
Ditto, weighing from 2,501 to 5,000 kg.—			
From Germany	387,000	234,000	– 153,000
,, Switzerland	89,000	139,000	+ 50,000
,, Great Britain ...	63,000	24,000	– 39,000
,, United States ...	694,000	98,000	– 596,000
,, Other countries ...	336,000	65,000*	– 271,000
Total	1,569,000	560,000	– 1,009,000
* France, 24,000; Sweden, 28,000.			
Ditto, weighing more than 5,000 kg.—			
From Germany	2,564,000	229,000	– 2,335,000
,, France	489,000	177,000	– 312,000
,, Great Britain ...	571,000	178,000	– 393,000
,, Switzerland	189,000	434,000	+ 245,000
,, United States ...	2,025,000	440,000	– 1,585,000
,, Other countries ...	66,000	346,000*	+ 280,000
Total	5,904,000	1,804,000	– 4,100,000
* Norway, 178,000; Sweden, 192,000.			

	1914. Pesetas.	1915. Pesetas.	Inc. or dec. Pesetas.
Accumulators and electric batteries.—			
From Germany	47,000	10,000	– 37,000
,, France	68,000	24,000	– 44,000
,, Great Britain ...	17,000	10,000	– 7,000
,, United States ...	23,000	28,000	+ 5,000
,, Other countries ...	37,000	26,000*	– 11,000
Total	192,000	98,000	– 94,000
* Sweden, 10,000.			
Cables and wires for electricity, with or without insulating material, of 1 cm. dia. or more.—			
From Germany	895,000	6,000	– 889,000
,, Great Britain ...	149,000	46,000	– 103,000
,, United States ...	137,000	53,000	– 84,000
,, Other countries ...	532,000	50,000*	– 482,000
Total	1,713,000	155,000	– 1,558,000
* France, 46,000.			
Ditto, less than 1 cm. in dia.—			
From Germany	207,000	8,000	– 199,000
,, France	33,000	26,000	– 7,000
,, Great Britain ...	22,000	36,000	+ 14,000
,, United States ...	23,000	54,000	+ 31,000
,, Other countries ...	8,000	3,000	– 5,000
Total	293,000	127,000	– 166,000
Telegraph and telephone apparatus, electric meters and parts.—			
From Germany	1,641,000	565,000	– 1,076,000
,, Belgium	45,000	5,000	– 40,000
,, France	174,000	425,000	+ 251,000
,, Great Britain ...	448,000	304,000	– 144,000
,, Sweden	261,000	596,000	+ 335,000
,, United States ...	11,000	295,000	+ 284,000
,, Italy	3,000	6,000	+ 3,000
,, Other countries ...	34,000	248,000*	+ 214,000
Total	2,617,000	2,444,000	– 173,000
* Norway, 15,000.			
Electrodes.—			
From United States ...	—	23,000	+ 23,000
,, France	—	32,000	+ 32,000
,, Germany	15,000	3,000	– 12,000
,, Italy	13,000	4,000	– 9,000
,, Other countries ...	6,000	1,000	– 5,000
Total	34,000	63,000	+ 29,000
Hydraulic motors.—			
From Germany	611,000	194,000	– 417,000
,, France	193,000	131,000	– 62,000
,, Great Britain ...	29,000	32,000	+ 3,000
,, Switzerland	387,000	1,241,000	+ 854,000
,, Other countries ...	50,000	29,000*	– 21,000
Total	1,270,000	1,627,000	+ 357,000
* Sweden, 28,000.			
Steam and gas engines (stationary) up to 10,000 kg. weight.—			
From Germany	298,000	31,000	– 267,000
,, Great Britain ...	490,000	332,000	– 158,000
,, France	88,000	20,000	– 68,000
,, Belgium	247,000	—	– 247,000
,, Italy	39,000	3,000	– 36,000
,, Other countries ...	21,000	159,000*	+ 138,000
Total	1,183,000	545,000	– 638,000
* Switzerland, 121,000.			
Ditto, from 10,000 to 25,000 kg. weight.—			
From France	—	49,000	+ 49,000
,, Germany	39,000	—	– 39,000
,, Great Britain ...	112,000	—	– 112,000
,, Belgium	59,000	—	– 59,000
,, Other countries ...	35,000	—	– 35,000
Total	245,000	49,000	– 196,000
Ditto, over 25,000 kg. weight.—			
From Switzerland	—	147,000	+ 147,000
,, Germany	579,000	—	– 579,000
,, Belgium	88,000	—	– 88,000
,, Great Britain ...	404,000	56,000	– 348,000
,, France	163,000	46,000	– 117,000
,, Other countries ...	—	1,000	+ 1,000
Total	1,234,000	250,000	– 984,000

	1914. Pesetas.	1915. Pesetas.	Inc. or dec. Pesetas.
Cylindrical steam boilers.—			
From Switzerland	—	25,000	+ 25,000
,, Germany	55,000	—	– 55,000
,, Great Britain ...	151,000	124,000	– 27,000
,, France	37,000	7,000	– 30,000
,, Belgium	92,000	—	– 92,000
Total	335,000	156,000	– 179,000
Multitubular boilers.—			
From Great Britain ...	1,540,000	1,444,000	– 96,000
,, Germany	476,000	94,000	– 382,000
,, Belgium	196,000	—	– 196,000
,, France	346,000	251,000	– 95,000
,, Other countries ...	24,000	12,000	– 12,000
Total	2,582,000	1,801,000	– 781,000

Note.—25 Pesetas = £1.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Temperature Indicators for Electrical Apparatus.

The rating of electrical machinery depends in most cases purely upon the temperature of the insulated windings; as a rule the efficiency is high on "overload" and even if this is not the case the fixed charges per KW. are so much reduced on overload that the loss in efficiency will often be comparatively negligible. Hence it is important to distinguish between the nominal overload which a machine is rated to carry and the actual overload which it can safely deal with in actual practice, bearing in mind that the duration of the overload is an essential factor in this question. Yet very little has been done hitherto with a view to enabling the operating staff to run machines at their full practical output, regardless of the figures on the name plate, though really important economies in capital cost might be effected by this means.

The *Electrical World* states that the General Electric Co., of Schenectady, has developed temperature indicators which, when used in conjunction with temperature coils in electrical apparatus, afford a convenient means of indicating continuously at the switchboard the temperatures of various portions of the windings of electrical apparatus under various conditions. The indicator is a direct-current differential indicator with three terminals. Its

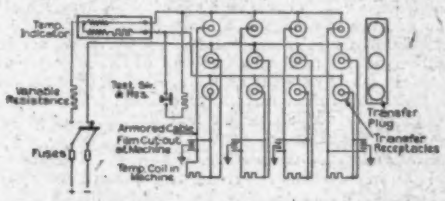


Fig. 1.—Connections of Temperature Indicators.

operation depends on the variation of resistance of a copper resister placed in a slot of the machine stator in contact with the insulation of the winding, or in any location, external or internal, where the resister may be protected from the conductors by suitable insulation. Four temperature coils are used on machines rated at 500 KVA. to 3,125 KVA., two of the coils being considered as spares. Above 3,125 KVA. six coils are used, three of which are spares.

One of the windings of the temperature indicator is in series with a coil of manganin, having a resistance equal to that of the temperature coils (usually at 80° C.). The other winding is in series with the temperature coil itself. When the temperature in the copper coil rises, the current in the branch of the circuit including the temperature coil decreases, causing a corresponding deflection toward the higher temperature end on the indicator scale. The reverse action occurs when the temperature of the temperature coil falls. The scale of the standard instrument has a range of 20-120° F. or 0-90° C., marked in 1° divisions. The temperature coils are made of copper wire wound in a thin form and pressed flat so as to be non-inductive. Current is derived from the supply circuit. The connections of the apparatus are shown in fig. 1.

Cable-pulling Eye.

In pulling cable it is considered good practice among some cable men to make an attachment to the cable conductors as well as the sheath in all duct runs over 375 ft. (114 m.) in length. To facilitate such a connection, one of the foremen of the General Electric Co.'s cable-pulling crew, working on large cables at Cincinnati, developed an attachment eye shown herewith, fig. 2.

This device is made in two styles. One of them is a solid forging about 9 in. (22·8 cm.) long, having an eye at one end. The shank is made of 1-in. (2·54-cm.) round stock, one end being upset or spread out in the form of a truncated cone. In this cone are

three grooves which extend from the base toward the shank of the device.

In using this device the sheath of the cable to be pulled is cut saw-tooth fashion for several inches back from the cable end; the lead is then turned back and the conductors are peeled. After this operation the conductors are laid in the grooves in the cone-shaped end of the pulling device, and the strands are served around the

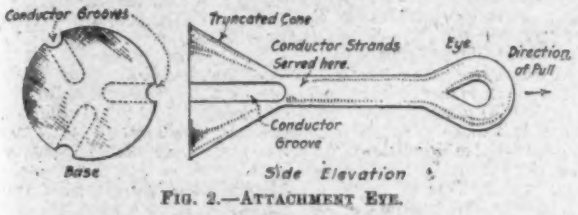


Fig. 2.—Attachment Eye.

shank of the tool. The saw-toothed lead-sheath ends are then bent down closely around the conductors and solder is sweated into the joint, making a smooth wiped joint. With these joints properly made it has been possible to break ropes designed to stand a 6·8-ton load without parting the joint between the cable and the eye. The second style of attachment eye is like the first, except that a swivel is used in the shank.—*Electrical World.*

Armature-winding Machine.

This machine has been invented with the idea of expediting the output, thereby cheapening cost, and to obviate the use of skilled labour, male or female. This applies especially to places where labour is of so migratory a character that it is always a problem to those who have to get this work done. The machine here illustrated is the experimental one, and will wind armatures up to 3 in. in diameter, but the machine as intended for commercial purposes will wind up to 5 in., after which it is usual to wind with formed coils. The inventor, Mr. L. E. Wood, A.M.I.E.E., states that the machine follows the hand method as nearly as it is possible to do so, fills the slots and piles up the ends in less space and more neatly than is possible by hand, and will wind 3 to 1 with the best female winder he has yet seen—that is with the experimental machine; better results are claimed for the commercial machine. No previous experience, skill, or training is necessary; any boy or girl can operate a number of machines according to the size of the armature and number of turns per coil. All that is necessary on the part of the operator is to put in the loop and

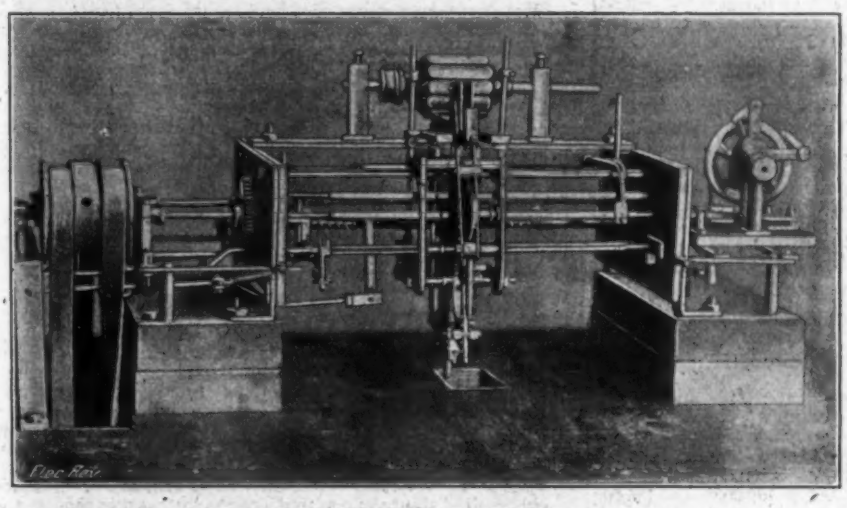


Fig. 3.—Armature-winding Machine.

revolve the armature to the next slot, which is done by a graduated disk, restart the machine, pass on to another, and repeat the process; an electrical device stops the machine when the predetermined number of turns is reached. The machine has been developed so as to be entirely automatic, if required—that is, to form the loop and move the armature to the next slot.

The power required to run one machine is approximately ⅛ h.p.; where a number of machines were used they would be grouped on shafting, driven by a suitable motor.

It is proposed to make the machine in two sizes—one for the smallest armatures up to, say, 2½ in., the other from 2½ in. to 5 in. The machine is in process of being patented in the U.S.A. and other countries, and the inventor would be pleased to hear from any one interested with a view to its being exploited in the United Kingdom. His address is P.O. Box 427, Valleyfield, P.Q., Canada.

Dynamic Balancing Machine.

True running balance may be quickly secured in an armature, motor crank shaft, turbine rotor, fan, or other high-speed rotating part by the use of a dynamic balancing machine built under the Akimoff patents, which is convenient to operate, owing to all the adjustments being made by turning hand-wheels while the machine is running.

The armature runs at the same speed and in the same direction as a dummy shaft. This shaft carries two weights, which may be shifted toward or from each other. The armature and the dummy shaft are supported together on a bed which is hinged at one end and free to vibrate vertically at the other end under the influence of any unbalanced couple in the armature or in the weights. When the weights are brought close together they exert no couple, but any running unbalance in the armature will cause the bed to vibrate. The weights are then moved to such positions that the couple they exert is opposite and equal to that exerted by the armature; the vibration then stops. Since the weights and their radius from the centre of the shaft are predetermined, it only remains to measure their distance apart to calculate the couple they exert. With this known, it is easy to calculate what weights should be added to or subtracted from points of known radius at known distances apart in the armature to produce a similar couple in the opposite direction. In order that the plane of unbalance may be determined, the dummy shaft is arranged so that it may be rotated with respect to the armature. The weights may be shifted on their shaft without stopping the machine.

To apply the readings of the machine to the object tested, a set of charts is used from which the readings in ounce-inches are converted directly into diameter and depth of holes to be drilled at the specified radii and specified distances apart. This is usually more convenient than adding weights.

The makers, the Carlson-Wenstrom Co., of Philadelphia, state that the machine will easily handle 100 armatures in an eight-hour day.—*Electrical World.*

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Employment of Disabled Soldiers.

It was with great pleasure that I perused your valuable journal of July 27th, and on page 87 you called attention to the recent advertisement which had the audacity to call for invalid young officers, at a salary, including war bonus, of 37s. per week, to act as switchboard attendants. It goes to prove that the undertaking concerned values the "invalided young officer," who has had to bear the "burden and heat of the day," at a low rate; and it is also unfortunate that the letters appearing on page 128 of your issue of August 10th have apparently been inspired by authors who have not yet had any experience of active service during the past three years.

I would point out to the authors of the letters that such an advertisement as referred to does not materially help their position, as it obviously follows that probably an advertisement might appear calling for shift engineers, worded similarly.

Before the war, the condition of pay to central-station men was deplorable, and it looks as if the advertisement in question tends to make the position worse. Therefore, it behoves those who are at present spared the trials and hardships of active service not to kick against the Editors of the Electrical Review, but to protest, and protest strongly, against the advertisement and the undertaking which inspired it. It is to be remembered that in these days hundreds of commissions are given from the ranks, irrespective of a man's station in life; therefore I cannot understand the attitude of the writers of the letters. If anything is to be done to raise the status and increase the salaries of central-station men as a whole, it must be by a concerted action, and not as a divided party. It would therefore appear that the steps taken by the Institution of Electrical Engineers, with their new scheme, are absolutely on the right lines; and I do most sincerely hope that the Institution of Mechanical Engineers and other kindred institutions will do likewise in organising some scheme to provide employment for those unfortunate invalided men who, in the prime of their vigour and manhood, have given their best to keep the invader at bay. The people at home, however much good work they may be doing, have no conception of a modern battle and the terrible conditions under which the men out here have to exist.

As one who has been on active service for over two years in France, an advertisement like the one quoted above caused me to wonder who was the author and what the central-station men think of it who are on active service on the different fronts.

It is to be hoped that after the above trespass on space in your valuable journal, the authors of the various letters will take a different view of the situation.

A.M.I.Mech.E., A.M.I.E.E.

B.E.F., France.

The Psychology of Shift Work.

In reference to my letter in your issue of August 17th, it should read: "Secretary, *Birmingham Station Engineers' Branch*, Electrical Trades Union."

Thos. N. Morris.

WAR ITEMS.

Trading with the Enemy.—In the "London Gazette" of August 17th is given an amended list of persons and firms in neutral and allied countries with whom trading is prohibited.

Employment of Women.—Returns made by employers to the Board of Trade show that since July, 1914, the number of women employed mainly in industries and commerce and Government establishments has increased by one and a quarter millions, and about the same number of men have been directly replaced by women. Between January and April, 1917, there was an increase of 54,000 women in industrial occupations.

Bribery in War Time.—The valuable "News-sheet" of the Bribery and Secret Commissions Prevention League, Inc., states that in the three war years ended August 4th there have been directly connected with the war 22 convictions on indictment under the Prevention of Corruption Act, and 27 summary convictions. During the same period there were 26 convictions, eight on indictment, purely civil. Together there were 90 cases, including five unfinished and 75 convictions, 56 of which belong to the present year, irrespective of convictions for bribery under other Acts and the common law.

A Dublin Wiring Contract.—The contract for the electric lighting of Coleraine House, Dublin—a Government Department—has been the subject of some comment. It is now officially announced that five contractors were invited by the Board of Works to tender for the work; that three responded, but that the tenders were in excess of the Board's estimate; and that, as no substantial modifications could be obtained, and as the work was urgent, it was decided to ask the General Post Office Telegraph Department, Dublin, to undertake the work. In the opinion of the Government, no further action is required, though, needless to add, local opinion differs.

Munitions Levy.—With the passing of the Finance Act the duty of assessing munitions levy up to December 31st, 1916, when the levy ceases, passes to the Board of Inland Revenue, and the staff engaged on this work is transferred to that department. In dealing with the question of the values of plant, buildings, and machinery erected or installed in controlled establishments for munitions work, the Board of Inland Revenue has made arrangements to retain the honorary services of the Valuation Advisory Committee of eminent experts, formed by the late Mr. Howard Chatfeild Clarke, and consisting of Mr. Basil Mott, Captain H. Riall Sankey, C.B., R.E., Lieut.-Col. C. L. Morgan, Mr. Leslie B. Vigers, Mr. H. M. Jones, and Mr. J. George Head, who have for the past 18 months been almost daily occupied in visiting controlled establishments in various munitions areas and advising the Ministry of Munitions on the extensions therein.—*Financial Times.*

A Munitions Council.—The Minister of Munitions has formed a body to be known as the Munitions Council, including the Minister as President, two Parliamentary Secretaries as Vice-Presidents, and 10 members, each representing a group of departments of the Ministry, together with a secretary. The staff of the Ministry at headquarters has increased from 5,000 a year ago to 13,500 at present; the Department employs in all about 2,000,000 persons, and is responsible for the expenditure of over 600 millions sterling per annum. The possibilities of further expansion to meet the needs of the situation are approaching exhaustion, and it is necessary to seek the means of increasing production by improving the efficiency of the organisation. The new Council will be the intermediary between the Minister and the component departments, which number over 50; it will aid and advise the Minister, and will fill a *rôle* similar to that of the Board of Admiralty or the War Council, relieving the Minister of much administrative work, and dealing with important questions affecting more than one group of departments. The scheme was brought into effect on Monday last, the following being the members of the Council and the groups of departments under them:—Finance: Sir H. Hambling. Design: Major-General the Hon. F. R. Bingham. Steel and Iron: Mr. John Hunter. Materials, &c.: Sir E. Moir. Explosives: Sir K. Price. Projectiles, &c.: Sir J. Stevenson. Guns: Sir G. West. Engines: Sir A. Duckham. Allies: Sir F. Black (*pro tem.*, Sir C. Ellis). Labour: Sir S. Kent.

China and the German-Asiatic Bank.—As a result of China's entrance into the war, the German concessions at Tientsin and Hankow revert to China, the large financial obligations to Germany are cancelled, and her extra-territorial privileges are abolished. All the offices of the Deutsch-Asiatische Bank have been sealed up, and foreign bankers, in conjunction with a Chinese official, have been instructed to liquidate its affairs.

German Methods in South Africa.—The August issue of "Production," the monthly report of the British Empire Producers' Organisation, contains an abstract of an address in which Mr. E. Saunders, of the S.A. Federated Chamber of Industries, explained the German "Circle System" which enabled the German engineering firm of Koppels to secure a grip of the mining and engineering trade of the Transvaal, and to continue trading freely even after the outbreak of war. Large groups of mines were worked on the "circle" system, almost all the orders for machinery going to Germany, and large portions of the surplus funds being invested in German, Hungarian, and Turkish securities before the war.

War Poetry.—We have received a copy of "Stand Down," a small book of poems written by Mr. Donald H. Lea, of the New Zealand Expeditionary Force; the author is the younger son of the late Mr. Henry Lea, the well-known consulting engineer, and we regret to add that owing to the ill-effects of being gassed in France, where he was serving in a Machine-Gun Section, he had to be invalided out of the N.Z. Force. In a brief "Foreword," Sir Thos. Mackenzie expresses the pleasure that the poems have given him, and we can cordially endorse the judgment of the High Commissioner for New Zealand. The poems all relate to incidents or aspects of the great war; a few are humorous, but most are pathetic, and some sublime. We defy any lover of children to read "First Aid" unmoved. The author is to be congratulated on his excellent work, and we trust that it will be continued.

Trade Cards and Exemptions.—At Southwark, Coun. Weaver drew attention to the decision of Mr. F. Mead, the magistrate at the South-West London Police Court, in dealing with a charge against an engineer of being a deserter, but who held a card under the protected trades schedule. Mr. Mead held that the card was *ultra vires*, as it was issued by a munitions area recruiting officer, to whom powers under the Military Service Acts could not legally be delegated. He maintained that the card was not an exemption, and was null and void, although the Military had given a promise to the holders of these cards that they should not be called up for military service. Coun. Weaver pointed out that it placed the men who held these trade cards in a very serious position, for by Mr. Mead's decision they held no legal exemption, and were liable to be called up for military service. If they did not join up they might be arrested and charged as being deserters. The Military Representative replied that Mr. Mead, who was the chairman of the Lewisham Tribunal, had always held that these cards were not exemptions under the Military Service Acts. In the case before the magistrate an error had been made by the military authorities, for when the man was arrested they were not aware that he held a card; but when they found that he did hold one, they did rightly in at once offering to withdraw the charge. Mr. Mead would not consent, and, ignoring the honourable undertaking the military authorities had given the holders of the cards, said, in effect: "I want to call public attention to the fact that these cards are not exemptions under the Acts." Everybody knew that; but the reason why this Tribunal, and many other Tribunals as well, withdrew their exemptions to holders of these cards was that it was undesirable for men to hold two exemption cards, one from a Tribunal and the other under the Protected Trades Schedule, for one might get lost, and be found and kept by another man not entitled to it. He thought the Tribunal had adopted the best course in withdrawing their exemptions to the holders of the cards, but granting them the right to apply to the Tribunal again for exemption should the cards be withdrawn. The Tribunal decided to continue to adopt this course.

Exemption Applications.—A singular application came before the Manchester Appeals Tribunal, when a man named Macintosh, aged 37, carrying on a dairyman's business in the day-time and acting as electric crane-driver and attendant-in-charge of a private electric light and power works in Salford at night time, appealed for exemption. Mr. E. C. Pearson, solicitor, who represented the man, said it was not claimed that he was a skilled electrician, but owing to the dearth of labour the firm had been obliged to put up with his services. If he were taken, however, they would have to replace him by a skilled electrician, as he was in possession of a red protected trade card from his last employment. His present wages were 43s. 6d., for 53½ hours a week. The appeal was dismissed, and the man was told he would have to rely on his trade protection card.

On the recommendation of the Advisory Committee, Rochdale Tribunal has granted conditional exemption to five motormen appealed for by the Corporation Tramways Committee; and until December 31st to J. B. Chadwick (41, B 2), coachbuilder, also appealed for by the Tramway Committee. Other appeals by the department were for J. Crossley (36, Class A), electric wireman, and for four motormen, three in Class A and the other in B 1. Mr. Webster stated that he had lost

43 drivers out of 88, and was still 14 short. He was trying to obtain substitutes wherever he could. Crossley was given conditional exemption, and the others were put back to November 15th.

Oswestry Tribunal has given exemption until January 1st to E. Jobson (37, Class A), electrical engineer.

At Weymouth, the borough electrical engineer appealed for the retention of W. O. Sargeant (26, Class A), stoker at the refuse destructor works. He stated that the Committee had not appealed for any of the 32 men employed at the works, and 24 had gone into the Army. The Military Representative contended that the occupation was not a certified one. The Town Clerk said that they had approached the Military, but they could not give a substitute. In reply to a question, Mr. Bolam said that with war bonus the man's wages were £2 2s. per week. The appeal was refused as from September 30th.

The County Appeal Court has dismissed a Military appeal against exemption until September 13th granted to an electrical engineer (39, B 2), in business at Hove.

Chester-le-Street Tribunal has given conditional exemption, on his undertaking some additional work, to J. Parmley (40), electrician at the Empire Picture Hall.

At a sitting of the East Kent Appeal Court, on August 13th, the Isle of Thanet Traction & Lighting Co. appealed against the variation of certificates granted to three drivers, aged respectively 37, 40, and 39, whose conditional exemption had been altered to exemption until September 1st. It was stated that as a result of an interview with the War Office, the latter had undertaken to find substitutes for the men, but none had arrived. The appeal was allowed, and exemption granted on each of the men remaining in their present certified occupations, unless suitable substitutes are found for them in the meantime.

At Oxford, the Tramway Co. asked for exemption for F. L. Chatwin (34, general service), fitter, and M. F. Sadler (33, C 1), unit adjuster, and each was temporarily exempted for three months.

At Wigan, an electrician who appealed claimed that he was indispensable to a firm of munition workers and Government contractors, and that he came within the list of certified occupations, and he was exempted until November 1st.

An appeal was made to the Herts. County Tribunal by Mr. M. J. Connari (37), electrical engineer, of Watford; appeal dismissed.

At Maidstone, three months' extended exemption has been granted to C. Butler (33, passed for general service), coal carman at the Corporation electricity works; and six months to J. E. Watkin (25, B 2), electrician at the Palace Theatre.

The Surrey Appeal Court has respited until called up an appeal filed by T. Hill (37, B 1), electrical engineer, of Farnham, he having been relegated to the reserve.

Frome Tribunal has granted a month exemption to two employés, single and passed for general service, of the electricity works, pending an appeal to the Munition Area Recruiting Officer for temporary exemptions.

The West Lancashire Rural Tribunal has refused an application for exemption for an electrical engineer and tractor driver by Major Fermor-Hesketh, of Rufford Hall. It was admitted that four tenant farmers on the estate had received notice to quit.

BUSINESS NOTES.

Ferranti Transformers. — Messrs. Ferranti, Ltd., have recently secured the following orders:—

Rotherham Corporation.—Four single-phase transformers, 2,085 K.V.A. each.
Manchester Corporation.—Annual contract for transformers, 250, 500 and 1,000-K.V.A. sizes.
Salford Corporation.—One three-phase 250-K.V.A. transformer.

Circulars and Catalogues.—Tradesmen's catalogues and price lists, and all classes of advertising circulars, with certain exceptions, may be issued and dispatched from now up to January 31st, 1918, to the extent of one-third of the weight of paper used for the catalogues and price lists and advertising circulars issued by tradesmen between August 1st, 1916, and January 31st, 1917. For the purpose of this licence the expression "advertising circulars" includes any advertising sheet or periodical in the form of a newspaper or magazine, whether registered as a newspaper or not, which is distributed gratuitously, and of which advertising is the main, and not merely an ancillary purpose; diaries, almanacs, and calendars issued gratuitously, and containing advertising matter; but does not include circulars requesting the verification of information for books of reference. The expression "paper" includes cardboard or other similar material, or any substitute for paper.

Bankruptcy Proceedings. — C. B. Ogilvie, Whalley Range, Manchester, electrical engineer.—First and final dividend of 2s. 2½d. in the £, payable August 27th, by the Official Receiver.

Trade Announcement.—British Electrical Federation.—The temporary address of the Federation and its constituent companies as from the 20th inst. is Manchester Hotel, Aldersgate Street, E.C. 1.

Sale.—Oldham Corporation has for sale two 740-KW. pets. See our advertisement pages.

Fire.—Early reports of the fire which took place at the works of the India-Rubber Co., Silvertown, on the 11th inst., appear to have been greatly exaggerated. Comparatively little damage was caused, and there was practically no disturbance to the manufacturing operations in the building involved.

Catalogues and Lists.—The London Telephone (New System) Co., Ltd., Donington House, Norfolk Street, W.C. 2.—Folder relating to the "New System" intercommunication telephone service.

Messrs. John Maclennan & Co., 90, Newgate Street, E.C. 1.—Card drawing attention to electrical insulating tapes and tubular sleeving, cotton, linen, and silk tapes, &c. Scales of centimetres and inches are printed on the edges of the card.

Mr. George Ellison, Wellhead Lane, Perry Barr, Birmingham.—Lists Nos. 151 and 304, the former describing the "Industrial Unit Type" switchgear, which is of the totally enclosed ironclad pattern for workshops and mines, each panel being a self-contained unit adapted for assembly with similar units to form a switchboard, and the latter relating to quick make-and-break switches operated by a tappet on a crane, hoist, or similar machinery, or by hand, with positive mechanism.

Book Notices.—*British Westinghouse Motors and Generators in Industrial Service.*—This brochure (Instruction Book No. 5,010/1) deals with the installation, operation, care, and repair of the B.W. motors and generators; but it will be of interest and value to erectors and users of all such machines. It contains concise and simple directions relating to the subject-matter, including allied considerations, such as lubrication, belts, starters, the causes of sparking, &c., and if carefully studied by attendants should be largely instrumental in prolonging the life and maintaining the efficiency of the machines concerned. It is issued by the British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester.

Messrs. Fawcett & Co., of 125, Strand, London, W.C. 2, announce the preparation of a history of British commercial houses which have been established over 100 years, under the title "Historic Firms of Great Britain and Ireland." They will be greatly obliged if firms coming under the scope of the publication will communicate with them.

Liquidation.—Anglo-Colonial Engineering Co., Ltd.—General meeting to be held on September 29th to hear an account of the winding-up from the liquidator, Mr. G. E. Corfield.

LIGHTING AND POWER NOTES.

Australia.—The newly-incorporated Borough of Sandringham (Vic.) has already decided to install electricity for lighting and power purposes. At the last meeting of the Council the Mayor reported that he had interviewed the Melbourne Electric Supply Co., and suggested that it should extend its mains or supply the Council with electricity in bulk. The company stated that it was prepared to extend the mains to the Black Rock railway terminus, where a transformer station would have to be erected to permit of the neighbourhood being served, but at present the company was faced with a shortage of cable, &c. With regard to the extension to Beaumaris, it would not be possible to undertake that work until after the war; in addition, it would be necessary to obtain permission to supply that district, for which it was about to apply. It was decided that the matter should be deferred for further consideration.—*Tenders.*

The Melbourne Harbour Trust proposes installing mechanical coal-handling plant capable of dealing with 400 tons of coal per hour; the present rate per hour of handling by man power is 60 tons. Tenders are to be invited for both steam and electrically-operated appliances (those electrically-operated being preferred), of which not less than two, or more than four, are to be employed to obtain the total output.

Mr. T. Murray, the engineer to the Victorian State Rivers and Water Supply Commission, is to furnish a report on the proposal of the Yea and Mansfield Dairy Co. to supply electric power for pumping water to the township of Yea.—*Tenders.*

Canada.—The report of the Toronto hydro-electric system for the year ended December 31st shows a gross income of $1,706,177, and after deducting working expenses, a gross surplus of $634,042; interest, depreciation, and sinking fund charges absorbed $615,646, leaving a net surplus of $18,396. The report states that the gross income is 5·3 per cent. in advance of that for 1915. Mr. H. H. Cousens, the general manager, states that the total KW.-hours sold in 1916 were greater than in 1915 by approximately 27 per cent.; the total revenue shows an increase of 6 per cent., in spite of rate reductions; the total number of private consumers is 43,460, with a connected load of 70,500 KW.; the capital expenditure amounts to $6,902,000; the sustained 20-minute peak load on December 4th, 1916, was 47,165 H.P.; the average revenue per KW.-hour for the whole system was 1·2 cents in 1916, as compared with 1·44 in 1915; the total number of KW.-hours sold was 139,000,000 in 1916, as compared with 109,000,000 in 1915 and 83,000,000 in 1914. Notwithstanding these heavy increases, the total cost of operation and maintenance has decreased from $550,000 in 1914 to $548,000 in 1915 and to $543,000 last year. An item of interest, as indicating the extent to which the customers of the Toronto hydro-electric system are utilising electrical

appliances of various kinds, is that, excluding lamps, 18,500 articles were sold from the hydro-electric showrooms, an increase of more than 30 per cent. over the previous year. The balance-sheet now shows total assets for the Toronto hydro-electric system of $8,882,171, made up roughly as follows:—Fixed assets, $7,501,186; stores in hand, $425,259; accounts recoverable, $241,461; capital funds in hands of city treasurer and cash in bank, $710,141. The report states that the necessary amounts have been set aside for interest, depreciation, and sinking funds, in accordance with the regular policy of the Commissioners.—*Canadian Electrical News.*

Continental.—Spain.—A concession has lately been granted for the establishment of a plant to utilise the water power of the River Mijares near Montargis (Province of Castellon) in the generation of electrical energy for power purposes.

Dundee.—The Electricity Committee has refused a request for compensation by the Yorkshire Hennebique Co. in respect of a contract entered into in May, 1915, in regard to which it was contended that a serious loss was incurred through the increased cost of labour and materials.

Finchley.—Proposed Extension.—At the last meeting of the U.D.C. it was announced that an increase of plant was necessary to the electricity undertaking, at a cost of £14,000. Permission to proceed with the proposed scheme had been refused, and a new one was being prepared.

Great Harwood.—Provisional Order.—The B. of T. has agreed to the request of the U.D.C. for an extension of the Electric Lighting Order, the date now fixed being August 7th, 1918.

Halifax.—Wages.—The Committee on Production has made an award of a 9s. per week advance on pre-war rates of pay for the semi-skilled employés of the Corporation—to the number of about 500. The men demanded 12s.; the Corporation offered 8s.

London.—Marylebone.—The annual statement of accounts of the B.C.'s electricity undertaking for the year ended March 31st last, shows a gross revenue from sales of electricity amounting to £185,465, as compared with £174,753 in the previous year, being an increase of 6·13 per cent. The average price decreased by ·09d. per cent. from 2·74d. to 2·65d. per unit. The total revenue amounted to £214,170, while working, management and establishment expenses accounted for £105,790, leaving £121,444 to be carried to net revenue account, which, with bank interest, totalled £121,716. Interest charges and loan instalments absorbed £114,753, and the net profit on the year's working was £6,963. During the year the final instalment of one of the short period loans was paid off, relieving this year's account of £4,740, and the ensuing and subsequent years of £5,358 per annum; another loan will be fully liquidated during the present year, which will further reduce the loan service charges by £850. The revenue, surplus and appropriation account at March, 1916, showed a balance of £13,917, which, with this year's net profit added, made a total credit of £20,880; of this £2,936 has been expended on new meters, mains, services, &c., other improvements accounted for £1,761, and after providing for depreciation of fittings on hire, there is a surplus carried forward of £14,582. During the year 17,647,146 units were sold, as compared with 16,069,870 in the previous year, the total works cost per unit sold being 1·216d., and the total all-in costs 2·773d.; the total average price obtained was 3·009d. The maximum load was 9,737 kw., and the load factor 20·7 per cent.

London Electricity Supply Conference.—At a conference recently held between the L.C.C. Special Committee on London Electric Supply and representatives of the City Corporation, Metropolitan Borough Councils, and the London Electric Supply Companies, upon the question of the electricity supply in London, the following resolutions were passed:—1. That, in the opinion of this Conference it is desirable that, before formulating a scheme for the electricity supply of London, the L.C.C. should consult the Metropolitan Borough Councils owning electric undertakings, the Metropolitan Borough Councils not owning electric undertakings, the City Corporation, and the London Electric Supply Companies. 2. That, in the opinion of the Conference, it is desirable that Metropolitan Borough Councils owning electricity undertakings, Metropolitan Borough Councils not owning electricity undertakings, and the various companies should appoint a Committee, or Committees, to confer with the Electricity Committee of the County Council.

Llandudno.—The Urban Council has decided to engage Mr. W. H. Patchell to report on the Council's electricity undertaking in relation to the supply of energy to the Light Railway Co. and on the economical working and the undertaking generally.

Mytholmroyd (Yorkshire).—Some time ago the D.C. declined to agree to an intended application by the Electrical Distribution of Yorkshire, Ltd., for a prov. order, and has since arranged with the Halifax Corporation to provide electricity. The Council, at its recent meeting, received a letter from the Power Co., stating that the Halifax Corporation had applied to it for a supply of electricity for Mytholmroyd consumers, and that the company had agreed to provide it; but for the war, it was added, the main would by now have been extended to Mytholmroyd.

Radcliffe.—Year's Working.—The engineer's report shows that for the year ended March last the electricity undertaking had a total income of £12,793, an increase of £2,546 on the previous year, while the gross profit was £4,292, after providing £373 for meters and war allowances; deducting interest and sinking fund charges, the net surplus was £254, as against a deficit of £176 in the previous year. Some 2,150,000 units were sold, as against 1,764,000 in the previous year; the department generated 1,056,000 units, and purchased 1,533,000 units in bulk from the Bury Corporation, the joint coal and bulk supply costs being ·467d. per unit sold. During the year a three-phase supply for textile driving has been inaugurated.

South Africa.—The Cape Town T.C. has made arrangements with the Cape Town Tramways Co. for a temporary supply of 200 to 300 kw., to be taken at the Council's convenience, so long as it does not interfere with the tramway service, the Council to carry out all necessary work at the power station, and to provide suitable meters.

The Paarl (Cape Province) hydro-electric lighting installation was recently opened; the lights were switched on by the Mayoress, this being the signal for the firing of a seven-gun salute.

Warrington.—Year's Working.—The accounts of the electricity undertaking show that the income during the past year amounted to £41,203 and the expenditure to £28,577, leaving a gross profit of £12,626. Loan charges and bank interest, less interest received, absorb £8,455, leaving a net profit of £4,171, as against £2,395 in the previous year.

TRAMWAY AND RAILWAY NOTES.

Belfast.—With reference to the views expressed by our correspondent in this column in our issue of the 10th inst., we gather from Mr. J. S. D. Moffet, general manager of the Corporation Tramways, that these are not in agreement with the facts, as regards fare revisions and extensions of the system. He states that the new fare scheme put into operation in May last has given an additional revenue of £8,000—a much bigger increase than was expected—and that its success is admitted. As regards the extensions, no new ones have been opened since 1912, so that they cannot be called recent. It is also untrue to say that certain routes are being run at a dead loss to the ratepayers, the difficulty being how to increase the services and so remove the grievance of overcrowding. Mr. Moffet further urges that, in any case, tramway facilities cannot be confined within artificial boundaries, in which we fully agree with him.

According to the *Belfast News Letter*, Mr. Moffet recently reported on the working of the tramways during the four months ended July 1st, from which it appeared that the total revenue was £108,204, as compared with £100,287 for the corresponding months last year. Due to additional expenditure, and after allowing for fixed charges, there was, however, a deficit of £1,981 for the period mentioned.

Bolton.—Wages.—The Tramways Committee has received an application from the Lancashire District Council of Tramway Workers for an advance of 7s. 6d. per week for all the members 18 years of age and over, including motormen, conductors, inspectors, and general staff. The Committee resolved that the application be not acceded to, but that the matter be referred to the Committee on Production for decision, and also that various other matters raised by the Association at an interview with representatives of tramway authorities on August 2nd, relative to the method of paying war bonus and payment of bonus for overtime should be embodied in such reference, with a view to the decision of the Commitee on Production being obtained thereon.

Brighton and Hove.—The B. of T. has granted an extension of time for the completion of the overhead equipment of the Brighton, Hove and District railless traction system, for one year from August 7th, 1917.

Dover.—Accident.—A crowded Corporation car descending Crabble Hill, on Sunday, got out of control, and finally collided with a wall and overturned, 10 people being killed and 35 injured. The driver jumped clear as the collision occurred, and escaped with minor injuries; the conductress was killed.

Dunfermline.—Following upon the appointment of Sir Eric Geddes as First Lord of the Admiralty, the construction of the tramway line between Dunfermline and Rosyth will be begun in the immediate future.

Edinburgh.—Increased Fares.—The Edinburgh and District Tramway Co. has decided to raise the fares. The company, it is stated, has been compelled to take this step in view of the refusal of the Corporation to reduce the rent. In a statement regarding the increased expenditure, Mr. J. R. D. Cox, general manager of the company, says it is highly probable that the cost of materials will further increase. In fact, the cable makers have already advised a further increase of £12 a ton, making a total increase in price since 1914 in this important item of 73 per cent.

Halifax.—Holiday Traffic.—The Corporation tramways experienced a time of great prosperity during the local "Wakes" week, which is the week following Bank Holiday week. The receipts during the four days, Saturday to Tuesday, were £2,344, as compared with £1,910 during the same period last year.

Huddersfield.—Free Rides.—The T.C., last week, agreed that members of the local Volunteer Force be permitted to travel on the cars at half fares when in uniform. An amendment that the recommendation be referred back was defeated. It was mentioned that 11,000 wounded and other soldiers travel free weekly on the local tramways.

Rochdale.—The Tramways Committee has decided to renew the overhead equipment between Heybrook and Littleborough.

Swinton.—At a meeting of the D.C., last week, it was announced that the South Lancashire Tramways Co. had refused to reopen the question of tramway service in the Swinton district. It was understood that it was going to revise the whole of the stages, but would not consider the question of transfer tickets at Swinton.

U.S.A.—The New York, New Haven, and Hartford Railway intends to reduce its schedule by 199 passenger trains a week, in compliance with national defence plans, and with a view to movements of troops and supplies. The Boston Elevated Railway has inaugurated a tank-car haulage system for transporting molasses during off-peak hours. A maximum of 12 tank cars have been filled, hauled, and emptied in one night, the distance being two miles, and the charge being equivalent to 18 cent per gallon as against 3 cent for team haulage when 13 trucks were employed.—*Electric Railway Journal.*

The four Chicago traction Bills, which would have enabled an extensive reorganisation of the city's transportation system to take place, have been shelved by the State Legislature until its next meeting, which may not be for two years.

West Riding Holidays.—A Yorkshire correspondent states that the high railway fares and the spread of tramways all over the West Riding of Yorkshire and Lancashire have resulted in large numbers of people from the West Riding cities and towns adopting, this summer, the comparatively new method of reaching Blackpool and other Lancashire holiday resorts by tramway. There are various routes from different industrial centres, but they mostly converge when over the border, and utilise the Preston tramway system as the final "jumping off" place in getting clear of industrial environment. Practically all the routes involve an occasional walk between the termini of different towns' systems, but, despite the repeated changing and transference of luggage by hand and the length of the journey, an increasing proportion of workers are realising the huge saving which can be effected in travelling costs. Many people from Bradford and Halifax, during the general holiday period last week, were grievously inconvenienced in utilising the Keighley way over the county border, by finding that the Keighley railless service from the tramway terminus did not commence until nearly mid-day.

TELEGRAPH AND TELEPHONE NOTES.

Federated Malay States.—During the past year 410,641 telegrams were dispatched and 451,417 received for delivery, an increase of 138,014. There are 2,210 miles of telegraph and telephone line in the country and 10,461 miles of overhead wire, of which 7,914 miles are telephone wires. In addition, there are 26½ miles of underground telephone cables, containing 2,413 miles of wire, single line.

Mexico.—After a lapse of several years, telegraphic communication has been re-established between Mexico City, Mexico, and the State of Yucatan.—*T. and T. Age.*

Secret Wireless Station.—Men of the Argentine Navy have discovered, on the coast of Chubut, Patagonia, a secret wireless installation. The authorities have seized the plant. It is thought that the station was used to communicate with suspect vessels in the South Atlantic.—*Birmingham Daily Post.*

United States.—The Government is making such heavy demands for telegraphists all over the country that the situation is assuming a serious aspect. The telegraph and telephone companies are experiencing very large increases of business, and it is with difficulty that they can keep up their own supply of working forces, let alone meeting the requirements of the Government. Approximately 6,000 telegraphists will be taken to secure the required strength of the Signal Corps department of the first military unit of 500,000 men; each succeeding unit of the same size will require 4,000 more.—*T. and T. Age.*

U.S. Telephones.—During the year 1916 the daily average of telephone calls in New York City was about 29,420,000.

The Bell Telephone system in the United States on May 31st owned 20,870,194 miles of wire, compared with 18,905,218 at the same time in the year 1916, and 10,256,068 connected stations, compared with 9,463,800.—*T. and T. Age.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Melbourne.—October 10th. Department of the Navy. Pumping plant and equipment for the Commonwealth Naval Dockyard, Cockatoo Island, Sydney. Specifications from the Director of Navy Contracts, Melbourne.

Kettering.—August 28th. Electricity Department. Supplying and laying 754 yards of lead-covered cable, with three-core pilot; feeder pillar, dividing boxes, switchboard instruments and stoneware troughing. See "Official Notices" August 17th.

London.—Bermondsey.—Sept. 7th. B.C. 500-kw. rotary converter. See "Official Notices" August 3rd.

New Zealand.—The Public Service Stores Tender Board, Wellington, N.Z., invites tenders up to 4 p.m. on September 5th, for the supply and delivery of (1) 30,000 dry cells for telephones; (2) 3,000 cords, 4 conductor; and 2,000 diaphragms for watch receivers; (3) 15,000 swan-neck insulator bolts and 20,000 cups to fit these bolts; and (4) 3,135,000 envelopes of various kinds. The conditions of tender, &c., may be consulted by British manufacturers at the Department of Commercial Intelligence, 73, Basinghall Street, London, E.C. 2.—*Board of Trade Journal.*

Portsmouth.—August 28th. Tramways Committee. Six months' supply of engine-room stores, insulating material, &c. See "Official Notices" August 10th.

Rathmines.—August 29th. U.D.C. 500 tons of coal for the electricity works. Particulars from the Electricity Department.

Spain.—The municipal authorities of Caceres have just invited tenders for the concession for the electric lighting of the town. Tenders have also lately been invited for the concession for the electric lighting of the town of Ferrol (Province of Coruna) during a period of 15 years.

The Spanish Post and Telegraph authorities in Madrid have just invited tenders for the supply of about 12 km. of telephone cable.

CLOSED.

Glasgow.—The Tramways Committee recommends acceptance of the following offers:—

Special trackwork.—Hadfields, Ltd.
Traction lamps.—Edison Swan Electric Co.; General Electric Co.
Steel pinions.—A. Wiseman, Ltd.
Gear-cases.—Equipment & Engineering Co.

The following tenders for plant at Dalmarnock generating station were recommended for acceptance by the Electricity Committee:—

Fraser & Chalmers.—One 500-kw. turbo-alternator, £6,180.
British Westinghouse Co.—One 500-kw. turbo-alternator, £6,300.

For static transformers for sub-stations:—

British Electric Transformer Co.—16 transformers, £1,932 each.
Ferranti, Ltd.—16 transformers, £1,924 each.

Government Contracts.—List of new contracts placed during July, 1917:—

War Office.

Electric bells.—W. Maxwell & Co., Ltd.; J. Sax & Co., Ltd.
Practice buzzers.—Edison Swan Electric Co., Ltd.
Generating sets.—Aster Engineering Co. (1913), Ltd.; O. Stott, Ltd.
Terminals.—Ingram & Kempe, Ltd.
Copper wire.—B.I. & Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., Ltd.
Works services.—Installation of electric power: Edmundson's Electricity Corporation.

Post Office.

Protective apparatus.—L. M. Ericsson Manufacturing Co., Ltd.
Telegraph apparatus.—I.R., G.P. & Telegraph Works Co., Ltd.
Telephone apparatus.—British L. M. Ericsson Mfg. Co., Ltd.; Gent & Co., Ltd.; Peel-Conner Telephone Works, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Telegraph cable.—Craigpark Electric Cable Co., Ltd.; Fuller's Wire and Cable Co., Ltd.; General Electric Co., Ltd.; Johnson & Phillips, Ltd.; New Gutta-Percha Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Telephone cords.—B.I. & Helsby Cables, Ltd.
Insulators.—Bullers, Ltd.
Jointing sleeves.—C. M. Powell Bros.
Solder.—B.I. & Helsby Cables, Ltd.
Insulator spindles.—Bullers, Ltd.; Guest, Keen & Nettlefolds, Ltd.; C. Richards & Sons.
Bronze insulated wire.—B.I. & Helsby Cables, Ltd.

Leigh (Lancs.).—Tramways and Electricity Committee. Accepted tenders:—

Wigan Coal & Iron Co., Ltd.—2,500 tons fine slack (Priestner's), at 11s. 6d. per ton; 1,200 tons rough slack, at 15s. 6d. per ton; and coke dust, at 6s. per ton, delivered.
Astley & Tyldesley Collieries, Ltd.—Engine fuel, at 15s. 9d. per ton, delivered.

NOTES.

The Channel Tunnel.—In the House of Commons, last week, Mr. Fell asked the Prime Minister if he could now say if the Government was in favour of the construction of the Channel Tunnel, and would support the Bill when introduced to give the necessary powers. Mr. Bonar Law replied:—The Cabinet have again carefully considered the question in consultation with their naval and military advisers, and they are still of the opinion that it is not practicable to proceed further with the matter during the continuance of the war. In these circumstances, it would not be possible for the Government to support a Bill of the nature indicated in my hon. friend's question.

Educational.—South-Western Polytechnic, Chelsea, S.W. 3.—The college will re-open on September 24th, for day and evening classes. Students are prepared for the London University B.Sc. degree in engineering, for the examinations of the engineering institutions, and those of the City and Guilds of London Institute. The evening courses also include classes in areonautics and electrical installation work. In the electrical installation department, an advanced course has been arranged for the preparation of candidates for the final examination of the City and Guilds of London Institute. Arrangements have been made for placing students who have passed satisfactorily through the three years' day course in positions with large engineering firms, and hitherto such firms have offered more vacancies than the Institute has been able to fill with its students. Further particulars can be obtained on application to the secretary.

Royal Technical College, Glasgow.—Particulars of the diploma and degree courses in Engineering, &c., for the new session (which begins on September 25th) are advertised in this issue.

University of London.—At a recent meeting, the Senate approved a memorandum, which has been forwarded to the Treasury, the Board of Education, the Civil Service Commission, the Government Committee on Science, and the Royal Society. It sets forth, in the first place, that education till the age of 16 should be general and not specialised, and should embrace not only literary, but also scientific studies. In the second place, it is laid down that natural science—including physics and chemistry—should be compulsory in all secondary schools.

In addition to the ordinary secondary schools, the Senate also desires that special technical day schools in accordance with local needs should be established in all industrial centres for boys and girls between 13 and 16 years of age who wish to enter technical industries at the age of 16. These schools would apparently form an exception to the general principle laid down, that education under the age of 16 should not be specialised.

The Senate in its memorandum next states that, in order to secure for science teaching the position to which it is entitled and which for the benefit of the nation it ought to occupy, the schemes under which the great public schools are administered should in each case contain provisions to the effect that:—(*a*) The governing body shall include a substantial number of representatives of the learned and scientific societies; and (*b*) that members of the governing body shall not hold office for life.

Without such provisions it is probable that men distinguished by mathematical and scientific attainments will continue to be at a disadvantage in applying for appointment to headmasterships of public schools. Greek should not be a compulsory subject for entrance scholarships to these schools, and adequate facilities, including equipment, for learning science should be available for, and accessible to, all their pupils.

Almost all the headmasterships of the great public schools are held by those who have taken classical degrees, and consequently in the schools in question science is relegated to an inferior position. In the few cases where a mathematician or scientist is headmaster, and science is well taught, the schools are so full that it is almost impossible for boys at the present time to gain admission.

Specialised first degrees in science at a university are deprecated in the memorandum. It is held that a student should first obtain a general degree in science, and then specialise in some branch of science or in the application of science to industry. This is probably the ideal training, but the question of time is of importance, and it may be found in practice that few, without valuable scholarships, can undertake such a lengthened course of study.

The Civil Service examinations are next considered, and the Senate suggests that the present arrangement for the selection of first division clerks in the Civil Service should be modified, so that on every occasion an adequate proportion of those appointed must have had mathematical or scientific training. In all selections for the higher administrative posts for the Government Departments, the work of which is of a scientific or technical character, the official selected ought to have received such a scientific training as will fit him to understand the character of the work for the organisation of which he will be responsible.—*Daily Telegraph.*

Books for British Prisoners of War.—Excellent work is being done in the way of enabling British prisoners of war usefully to employ their time during internment by Mr. A. T. Davies, C.B., of the Board of Education, chairman of the British Prisoners of War Book Scheme, the war charity which provides British prisoners interned in enemy or neutral countries with books for study purposes. Through the instrumentality of the organisers of the book scheme arrangements have been made, and in some cases have been in operation for a considerable time, whereby examinations have been held, at a foreign camp, of those students who have been desirous of taking their examinations notwithstanding their internment. Increasing use, too, is being made by the prisoners of the "Form of Record" prepared by the Committee of the Book Scheme, which enables the regular studies in any subject of a "Student Captive" to be duly recorded and certified with a view to the record assisting him on his return from captivity at the close of the war. Contributions in aid of the scheme are urgently needed. In the technical and scientific sections the prisoners' demand for books is very large, but the works asked for are rarely obtainable as gifts, as the owners generally need them for their own use, while second-hand copies, sufficiently up to date, are proving increasingly difficult to procure. In these circumstances, the Committee is compelled to make large purchases of new copies of up-to-date books of the above character, and, for this, ample funds are essential. Offers of books (which should always be accompanied by a detailed list) are also invited, and should be addressed to Mr. A. T. Davies, C.B., "Prisoners of War," Board of Education, Victoria and Albert Museum, South Kensington, S.W. 7.

Volunteer Notes.—County of London Volunteer Engineers (Field Companies).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—

Officer for the Week.—Platoon Commander C. Campbell.

Monday, August 27th.—Technical instruction (searchlight) for No. 3 Company, Right Half Company, at Regency Street. Drill, No. 3 Company, Left Half Company. Signalling Class. Recruits' Drill, 6.30.

Tuesday, August 28th.—Lecture, 6.30. Physical drill and bayonet fighting, 7.30.

Wednesday, August 29th.—Drill and elementary bridge construction for No. 1 Company, Right Half Company.

Thursday, August 30th.—Drill and elementary bridge construction for No. 2 Company, Right Half Company. Ambulance Class.

Friday, August 31st.—Technical instruction (searchlight) for No. 3 Company, Left Half Company, at Regency Street. Drill, No. 3 Company, Right Half Company. Signalling Class. Recruits' Drill, 6.30.

Musketry.—All N.C.O.'s and men who have signed the "A" and "B" agreements are required to attend during this month to reclassify in order to enable the corps to obtain the capitation grant. Preference will be given to those men in firing.

(By order) Macleod Yearsley.

Tyneside Volunteers.—A joint meeting of the electrical section of the Newcastle-upon-Tyne and Gateshead Chamber of Commerce and the Local Section of the Institution of Electrical Engineers was held on the 14th inst., at Newcastle, Mr. H. W. Clothier presiding. It was in relation to the raising of certain specialist units for the Durham and Northumberland County Volunteer Regiments. The units required were signal companies and electric light companies for what will become the County Engineer Corps. The suggestion was to raise two electric light companies south of the Tyne, one north of the Tees, and one in the Hartlepool area of Durham; and one similar company at Newcastle, one at Tynemouth, one at Blyth, in Northumberland. It was proposed to form one signal company for Durham, with six sections centred at, respectively, Gateshead, South Shields, Sunderland, Hartlepool, Stockton, and Darlington. The sections of the Northumberland Company would be located two at Newcastle, one at North Shields, one at Blyth, and one at Morpeth. The establishment of an electric company was put at 87, and of a signal company headquarters section 38, and of other sections at 24.

The Chairman said the whole industry was alive to the necessity of moving with the times, and it was most essential for the individual members themselves to take an active part in such movements. He said they were being approached in various matters, and instanced the action of the Electrical Section of the Chamber of Commerce with respect to the giving of evidence before the Board of Trade Electrical Committee on the development of power stations. The matter before them that night was one which concerned them individually.

Col. W. C. Blackett, County Commandant, Durham Volunteer Regiment, said there was real need for the appeal they were making to raise those units for the Volunteer Regiments, to have them ready for any emergency that might arise. They had twelve battalions of infantry, and engineering corps (in which the signalling and electric light corps would be included), artillery, transport and medical corps were being raised. They had hopes of raising two companies of the electric light corps at Hartlepool, and wanted two at Tyneside. As to the signalling companies they had three movements under way which they hoped would bear fruit.

Captain Barnes laid stress upon the urgency of the matter, and gave details as to the formations, emphasising the importance of the signalling companies, upon which matter Capt. Worsley also spoke. The latter stated that a very important part of the work of the signalling company was to deal with field telephones, and there would be also motor cycle sections.

The Chairman moved: That this meeting representing the electrical industry of Tyneside give the appeal their heartiest support. Mr. Lunn seconded and the motion was carried.

As the outcome of the above meeting, the following preliminary arrangements have been made for the Durham area:—Mr. H. W. Clothier, of Messrs. A. Reyrolle & Co., Hebburn-on-Tyne, will confer with Mr. Pyne, of Palmer's, Hebburn, with a view to raising an electric light company for that district. From Hartlepool Engine Works, under the direction of Mr. D. B. Morison, two electric light companies will be formed, and the names of 150 men have been sent to the County Territorial Association. There are also 24 men for the signalling section awaiting word from headquarters to commence training. In connection with the Horden Coal Co., South Shields, a signalling section is proposed, Mr. H. S. Ellis, borough electrician, acting as organiser. At Sunderland, Mr. Windle proposes to co-operate with local firms with a view to raising a signalling section. At Stockton-on-Tees, Lieut. J. Riley is to co-operate with Messrs. Riley Bros. in raising a signalling section. In regard to the county of Northumberland, it is stated that the Newcastle Electric Supply Co. are raising a special unit amongst their men in connection with their own plant. This unit would engage principally those in the operating department, and other members of the staff may be available to co-operate with consulting engineers with a view to raising a signal section in Newcastle. Members have already signed on for different units.

Any gentleman or firm, who was not able to be present at the meeting and who is interested in the movement, is asked to communicate with Mr. Herbert Shaw, Secretary, Newcastle Chamber of Commerce.

National Insurance (Unemployment) Acts, Unemployment Insurance.—The Umpire has decided that contributions are payable in respect of :—

2,372 X. A steam-hammer forger engaged in making copper refining ladle plates and rabble heads and light forgings for use in copper, spelter, and steel works.

2,375 X. Workmen engaged in screwing tubes.

2,377 X. Workmen engaged wholly or mainly in making metal laths.

2,378 X. Workmen engaged in corrugating and curving galvanised metal sheets.

2,380 X. Workmen engaged wholly or mainly in the manufacture of accumulator cell boxes or of lead linings for such boxes.

2,381 X. Workmen engaged in making wrought or welded iron pipes for use as telegraph poles.

2,383 X. Workmen engaged wholly or mainly in making and fitting together wrought-iron parts of small forges for heating rivets.

The Umpire has decided that contributions are not payable in respect of :—

2,369. Switchboard attendants and workmen engaged wholly or mainly in minding, tending, or driving electrical machinery in connection with uninsured trades.

2,373. Joiners engaged wholly or mainly in making by hand wooden drums for electric cables.

2,384. Workmen engaged wholly or mainly in making vulcanised fibre parts of electric light fittings which are not intended for use in war.

Tribute to Samuel Insull.—Officers and directors of the Commonwealth Edison Co. celebrated the twenty-fifth anniversary of Samuel Insull's presidency of the company and its predecessors by giving an "Edison Family Birthday Party," on June 25th.

In an address acknowledging the tributes, Mr. Insull reviewed the gigantic growth of the company and its predecessors, as well as of the other corporations composing what is commonly called "the Insull group." These companies have an aggregate capital of $445,000,000, and the gross annual turnover is $75,000,000. On the average, this shows that the companies turn over their capital about once in six years. The companies pay a little less than $5,000,000 in taxes, and serve 1,500,000 customers living within an area of between 58,000 and 60,000 square miles. They have between 20,000 and 25,000 employés.—*Electrical World.*

Commercial Intelligence Service.—Lord Robert Cecil and Sir Albert Stanley are submitting to the Commercial Committee of the House of Commons a new scheme for a Commercial Intelligence Service. The suggested arrangements have been approved by the Cabinet. An emergency meeting of the Committee has been convened to consider the scheme.—*The Times.*

Inland Water Traffic.—The Canal Control Committee has issued a letter directing the attention of manufacturers, merchants, and others to the desirability of using the inland waterways of the country for the conveyance of goods of all kinds. The letter points out that the principal object for which the Canal Control Commitee has been appointed is to relieve the traffic on the railways by increasing the amount carried on canals.

Since the beginning of the war, both the canal companies and the carriers on the canals have lost a considerable number of their employés, but the Committee is taking steps to provide crews for as large a number of boats as possible, and it is hoped that a greater number of boats capable of carrying traffic will be available at an early date.

The A.E.S.E. and Central Station Staffs.—As we go to press we have received the following letter :—

"Staff," that magic word, I notice has occurred with remarkable frequency of late in various articles and correspondence anent electrical station engineers appearing in the REVIEW.

The "staffs" of electrical stations are apparently realising that they have had no say in the scheme of things, where those employed in stations *not on the staff* have had a great deal to say through their organisations, and have influenced to some extent Acts of Parliament, war bonuses, &c.

The liberty of action of the staffs has been curtailed by Acts of Parliament and Regulations agreed to by organisations of employés not on the staff.

Staff engineers of this country *must* rouse themselves ; they *must* strengthen existing staff organisations, and must be prepared to subscribe to these organisations an amount yearly at least equal to that subscribed by a member of a skilled Trade Union. They can then, *at least*, be on an equal footing with employés not on the staff with regard to influencing regulations concerning their employment.

The Government does not deal with individuals ; it now invites representatives from various organisations when some new regulation with regard to any industry is proposed.

It is certain that the time will shortly arrive when vast new regulations will be made to regulate the transition from munitions of war manufacture to reconstruction and ordinary peace industries.

Only those men who are organised will have any say in the matter. Fitters, wiremen, and labourers are organised, and have been consulted on various matters appertaining to their employment. The staff engineers must organise, if only to preserve their position.

Will they take the opportunity before it is too late ?

W. J. EBBEN, *Hon. Secretary A.E.S.E.*

26, Little Park Gardens, Enfield,
August 20th, 1917.

Fatalities.—A collision between a taxicab and a motor-wagon at Aspley, Huddersfield, on Thursday last, resulted in injuries to Lance-Corporal Edward William Chinn, of the Royal Engineers—formerly a driver on the Huddersfield tramways—from which he died later in the day at the infirmary. Verdict, "Accidental death."

Arthur Suthers, aged 28, an electrician employed by the Cleveland Bridge and Engineering Co., at Darlington, was working on a platform of a travelling crane, on Saturday, when he was knocked off accidentally and fell 30 ft. to the ground, receiving fatal injuries.

Leaving Certificate Case.—At Oldham Munitions Court, an electrician employed at a local electrical engineering establishment applied for a leaving certificate. He said he was asked to do "navvy's work" to get through a 2-ft. wall, in order to wire a private office, and he was not going to do it. He received 47s. 5d. for a 49½-hour week, which, he said, was not the standard rate. He was not on war work, though he had been previously, and he had been offered a post at Sheffield. The representative of the firm said they were not on munitions, and so could not grant a leaving certificate. The President said the Court had no sympathy with the plaintiff, and, in granting the certificate, they wished to remind him to be careful, or he might have to prefer the trenches.

Textile Research.—In their annual report, the Tootal Broadhurst Lee Co. announced that "assured of the importance of research and education in the struggle for the world's trade, the directors have decided to set aside £10,000 for five years for this purpose." The Provisional Committee on Research and Education for the cotton industry will, at the close of the current holiday season, issue a prospectus of the new Government-incepted and aided organisation. This definite industrial research federation of the cotton trade will be followed by the establishment of institutes and laboratories.

The Anchor Hospital and Distress Fund.—The sixth annual general meeting of members of the Hospital and Distress Fund, in operation at the Anchor Cable Works, Leigh, was held on August 16th. There are three separate funds in existence, and the balances standing to the credit of these funds at June 30th, 1917, were as follows :—

The Hospital and Distress Fund ...	£240	2	4
The Belgian Refugee Fund	108	13	6
Special War Fund	339	14	0
	£688	9°10	

The parent Hospital and Distress Fund has for its objects :—

(*a*) The granting of annual sums to hospitals and convalescent homes, &c., thereby ensuring to members hospital treatment in case of accident or other sickness.

(*b*) The granting of temporary relief to members in exceptionally distressed circumstances, so that shop collections may be discontinued.

All the employés in the works and offices at Leigh, aged 17 years and over, are members, and contribute according to their means sums varying from 1d. to 8d per week.

The Committee of the Fund is responsible for the administration and distribution of the allowances made by the firm to dependents of members who have joined His Majesty's Forces, and is also responsible for the maintenance of a Belgian refugee family. From the special war contributions of members parcels of comforts and cigarettes and tobacco are regularly sent out to the firm's employés on active service, and during the 12 months ended June 30th last a total sum of £210 was distributed amongst the various local and national war funds. At the general meeting it was decided to make grants amounting to more than £200.

It should be added that the good work of the Fund could not be continued were it not for the generous assistance rendered by the directors and management of the company—Messrs. Callender's Cable and Construction Co., Ltd., of London and Leigh.

Competition for Electric Cookers.—According to the *Génie Civil*, the Société Générale Italienne d'Electricité Edison has opened a prize competition for the construction of an electric cooking outfit of the thermal storage type, designed to consume as little energy as possible, and to spread the daily demand over the longest possible period, the criterion being the ratio between the consumption in KW.-hours and the maximum demand in KW. The conditions are that before March 31st, 1918, at least three samples shall be submitted, suitable for a family of five or six persons, as well as particulars of smaller and larger sets. The Société Edison has placed 10,000 lire (£400) at the disposal of a commission for distribution in the form of one or more prizes.

Munitions and Labour.—The Minister of Munitions, accompanied by officials of the Ministry of Munitions, Admiralty, and Ministry of Labour, met representatives of the Engineering and Shipbuilding Trades Federation in the Central Hall, Westminster, on August 22nd. He explained to them that the principal object of the meeting was to set up an advisory committee of trade unionists, the appointment of which had been discussed at previous conferences. The delegates indicated that they had every intention of helping him in his work. Their proposals as to the membership of the advisory committee were handed to the Minister in the course of the afternoon.—*Daily Telegraph.*

Patents and Alien Enemies.—Licences have been granted by the Board of Trade to the Chesham Supply Co., Ltd., in respect of 10 patents granted to Simms and Robert Bosch.

A Large American Loan Issue.—The *Electrical World* states that the General Electric Co., of Schenectady, has arranged a loan of $15,000,000 for three years, to provide for the demands of a largely increased business. The company expended nearly $9,000,000 on additional plant facilities in 1916, and will spend much more this year. The live assets of the company, as shown by its last annual report, excluding securities, amounted to $97,000,000, and the indebtedness, excluding current liabilities, to $12,000,000. The new issue was made at 6 per cent. to Messrs. J. P. Morgan & Co. and Lee, Higginson & Co. The subscriptions are said to have aggregated $80,000,000.

Removing Rust by Electrolysis.—An electrolytic process of deoxidisation has been patented in the United States. The object to be treated is made the cathode in an electrolyte containing phosphoric acid. In addition to its normal function of carrying the current, this acid acts as a solvent upon rust without attacking the steel or iron body beneath. It is in this last detail that its chief availability lies, since nitric, sulphuric, or hydrochloric acid would not display such moderation. Finally, the phosphoric acid is beneficial in preventing subsequent further rusting. The electrolyte is made by adding 10 parts of phosphoric acid to 90 parts of water, or by adding 10 per cent. of the acid to a 10 per cent. solution of sodium phosphate. A temperature between 50° and 70° C. is recommended.—*Scientific American.*

South African Institution of Engineers.—The report of the Council for the session 1916-17 states that, as a result of the work of a Joint Committee formed in 1915-16, a conference of the Councils of the Mining, Electrical, and Engineers' Societies was held in May, which agreed that the time was ripe for the closer working and joint housing of all scientific and technical societies, and a Committee is to be appointed to prepare a scheme. Mr. C. T. Elliott, the secretary, having resigned, Mr. W. R. Jago was appointed in his place. The membership of the Institution numbers 488, a net increase of 25; 72 members are on Active Service or war work. The income was £1,345 and the expenditure £1,585; the capital fund stands at £2,330. At the annual general meeting the president presented the Institution Gold Medal to Lieut.-Colonel J. H. Dobson, D.S.O., for his paper on the Johannesburg electricity works, and referred to his splendid work in German East Africa. Owing to the death of Mr. D. Cullen, the only nominee for the presidency, the election of president had to be deferred to the next general meeting. Mr. Bernard Price, the retiring president, then delivered his valedictory address, dealing mainly with the past year's work, and especially the proposed federation of technical societies on the Rand, which, he believed, was a matter of national importance.

Importation Prohibited.—A Royal Proclamation prohibits the importation, save under licence from the Board of Trade, of all machinery driven by power and suitable for use in operating on wood, including electrical motors up to ½ H.P.

Electrically Equipped Seminary.—A recent issue of our American namesake, the *Electrical Review* of Chicago, contained a description of the electrical equipment of the St. Stanislaus Seminary, near St. Louis. This institution consists of several large buildings, as well as outbuildings, including a bakery, shoe shop, laundry, cannery, cold storage, dairy, pumping station, smith and carpenter's shops, winery, garage and stables, a 900-acre farm being part of the property. To supply it a 13,200-volt line, built with galvanised iron wire, was run 6 miles from the 60-cycle transmission line of the Electric Co., of Missouri, the seminary guaranteeing a connected load of 60 KW.

At the seminary end the line is led into a distribution house, whence 110-volt lighting circuits radiate to the various buildings, underground cable being used. In all 600 lamps of 22,000 watts capacity are installed. For the farm supply two 220-volt underground lines run from the distribution station; one of these supplies a 10-H.P. laundry motor, a 10-H.P. ammonia compressor motor, and a 5-H.P. well-pump motor. A 10-H.P. corn grinder, a 10-H.P. circular saw, and a cream separator motor are also operated. The lighting for the farm buildings is taken off the power supply, up to 20 per cent. of the connected power load.

In the kitchen of the infirmary, a General Electric range is installed, also two 18-in. exhaust fans for use in vacuum cleaning. Heaters are being placed in the rooms and tests are being made for space heating.

The community kitchen is to have an electric bake-oven to bake 100 24-oz. loaves per hour, and an electric range to cook meals for 350 persons. This range will have four large ovens and two broilers to deal with 140 lb. of steak an hour. All vegetables, soups, &c., will be prepared in six electric steamers, and all roasting is to be carried out in a special oven. A plate-warmer, potato peeler, meat and coffee grinders are also included in the equipment.

All water heating for cooking, dish washing and bathing will be done electrically by two 300-gallon heaters which will furnish some 1,000 gallons of water at 180° every 24 hours.

Electrically heated coffee and tea-urns will be supplied with initially heated water from this source. The bakery has been equipped with an electric dough-mixer driven by a 2-H.P. motor, also with three electric baking ovens each with a capacity of 100 24-oz. loaves an hour. The output of two of these ovens has easily equalled the combined rated capacity of all three. In each oven three heats are employed. Previously the brick ovens in use required 24 hours' heating to obtain the proper temperature; with the electric ovens 1½ hours suffices. Already well defined monetary savings are being made over the previous costs.

Appointments Vacant.—Car-shed mechanic (36s.—42s.), for Exeter; shift engineer, Birmingham Corporation; switchboard attendant for the Leek U.D.C. Electricity Works. See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—A request has been received by the Dublin Corporation from the Coal Mines Department of the Board of Trade for the part-time services of Mr. LAURENCE J. KETTLE, deputy city electrical engineer. The Corporation has acceded to the request.

The Rochdale Electricity Committee has decided to recommend the appointment of Mr. F. H. RUDD as permanent electrical engineer to the Corporation, at a salary of £400 per year, with a further increment of £50 within 12 months. Mr. Rudd has been the acting engineer since the resignation of Mr. C. C. Atchison.

The Greenock Electricity Committee recommends that the salary of Mr. FRANK H. WHYSALL, the burgh electrical engineer, be increased by £100, which will bring it up to £700.

Mr. W. E. THORP has been appointed inspector on the Doncaster Corporation tramways. He was engaged in the service prior to the war, has been to the Front, and has been discharged as unfit for further military service.

General.—The marriage took place last week, at Erith Parish Church, of Mr. E. J. DAVIS, and Miss Mabel May Vaux, second daughter of Mr. J. H. Vaux, of Callender's Cable & Construction Co., Ltd.

The marriage took place, at Crewe Green Church, last week of Sapper HUBERT SIMPSON, London Electrical Engineers, late of the staff of the Crewe Corporation electricity works, and Miss Melville Alcock, only daughter of Coun. C. Alcock, of Crewe.

At St. Paul's Church, Helsby, the marriage has taken place of Mr. N. GREENING, only son of Mr. N. Greening, of Newlands, Frodsham, and Miss Elsie Brotherton, younger daughter of Mr. J. Brotherton, J.P., manager of the Helsby Cable Works.

Roll of Honour.—Captain ESMOND WILLIAM MILNES, R.G.A., who has succumbed to wounds, was manager of the electric power station at Tres Arroyes, Argentina, and returned home in 1915 to take up a commission.

Lieut.-Col. MACRORY, D.S.O., wounded, is a brother of Mr. R. V. Macrory, city electrical engineer, Londonderry.

Lieutenant DOUGLAS KENNETH BEST, son of Mr. Walter Best, of the electric light department, India-Rubber, Gutta-Percha & Telegraph Co., Silvertown, was killed in action on August 16th. He joined the London Rifle Brigade in 1913, and went with the 1st Battalion to France in October, 1914. He was given a commission in the 6th Essex in 1915, and went through the Dardanelles; afterwards he went to Egypt, where he saw some further active service. He was then attached to the Royal Flying Corps, and sent home to complete his training. He obtained his wings this year, and was sent to France a short time ago. He was employed for some time in the test room of the electric light department at Silvertown, and afterwards with Messrs. Wallace Bros., Ltd., of Crosby Square, and was within one month of his 21st birthday.

Private A. E. WERRELL, of the Royal Fusiliers, who was wounded in France on August 2nd, was outside representative of the A.E.G. Electric Co. up to the outbreak of war.

Gunner MAURICE LIGHTOLLER JONES, South African Heavy Artillery, who died on April 22nd, 1917, was for 10 years accountant to the British General Electric Co., Ltd., Cape Town.

Company-Sergeant-Major R. EDWARDS and Sergeant S. DAVY, York and Lancaster Regiment, who were before the war on the Rotherham Corporation tramway staff, have been promoted to the respective ranks of Regimental-Sergeant-Major and Company-Sergeant-Major.

Private J. COOPER, Royal Dublin Fusiliers, who enlisted whilst with Messrs. Siemens, of Stafford, has fallen in action.

Private J. A. MITCHELL, Seaforth Highlanders, who has fallen in action, was a driver on the Corporation tramways at Croydon.

Sergeant BERNARD CHAPMAN, Northants Regiment, who has died of wounds, was engaged with the Premier Accumulator Co.

Private A. PHILLIPS, Royal West Surrey Regiment, who joined up whilst a motorman with the Swansea Tramways Co., is reported missing since May 12th last.

Lance-Corporal E. RICHARDSON, East Kent Regiment, who was prior to the war engaged at the Maidstone Corporation electricity works, is reported dead after being missing since October 7th, 1916.

Lance-Corporal C. Bishop, Sussex Regiment, killed in action, was formerly with the Brush Electrical Engineering Co., Ltd.

Sergeant A. B. Clifford, Royal Engineers, formerly in the electrical department at Wharncliffe Silkstone Colliery, has been awarded the Meritorious Service Medal for special work at the front in connection with mining.

Private W. Clark, West Yorks Regiment, who was on the Halifax Corporation tramway staff, has fallen in action.

Sergeant J. Berryman, Royal Fusiliers, son of Inspector Berryman, of the Torquay Tramway Co.'s staff, and who enlisted whilst a motorman on the system, has been promoted to the rank of Company-Sergeant-Major.

The Military Cross has been awarded to Sec.-Lieut. Edward Harley, York and Lancaster Regiment, formerly assistant electrical engineer to Hastings Corporation.

Formerly employed on the Blackpool and Fleetwood tramways, Private J. Simpson, A.O.C., has died from heat-stroke in Mesopotamia. He was 38 years of age.

Signaller-Sergeant F. Hill, in hospital in France, suffering from shrapnel wounds, was employed in the Lytham & St. Annes tramway offices.

Private R. A. Stewart, of Wallasey, who has been killed in action, was an electrical engineer in Liverpool.

Private Frank Smith, who has been killed in action, was on the tramway staff of the Doncaster Corporation.

Corporal W. Holt, Machine Gun Corps, of Crawshawbooth, has been awarded the Military Medal, and also recommended for the Distinguished Conduct Medal. Prior to enlisting he was employed in the British Westinghouse Co.'s works.

Private J. Coddick, King's (Liverpool) Regiment, has died from wounds received in action; he was employed by the Automatic Telephone Manufacturing Co., Ltd.

Private N. Taylor, West Riding Regiment, who is reported missing, was employed by the Halifax Corporation tramway department.

Private H. Brooke, of the Grenadier Guards, who has been killed in action, was a driver on the Bradford Corporation tramways prior to the war.

Company-Sergeant-Major Hugh Houston, York and Lancaster Regiment, formerly with the Glasgow Corporation tramways, has been awarded the Military Medal for conspicuous gallantry.

Lance-Corporal J. Leslie, King's Own Scottish Borderers, a former employé of the Glasgow Corporation tramways, has been posted as missing.

Private H. Burns, Manchester Regiment, previously reported missing, and now officially posted killed, was employed by Messrs. W. T. Glover & Co., Ltd., cable makers, Trafford Park.

Private B. Reilly, Lancashire Fusiliers, killed in action, was formerly employed by Messrs. Charles Macintosh & Co., Ltd., cable makers, Manchester.

Obituary.—Theodore Turrettini.—In *La Revue Générale de l'Electricité* the death of M. Théodore Turrettini is recorded; he was a Swiss engineer of the first rank, and took part in 1868 in the first test of Siemens & Halske's electric generators at Berlin. He was one of the experts advising on the utilisation of Niagara Falls in 1891, for 20 years a member of the Administrative Council of Geneva, and for long periods a member of the municipal and national councils, a colonel of artillery, and consulting engineer to many important undertakings.

Will.—An estate of the gross value of £405,965, with net personalty £390,056, has been left by Alderman Isidor Frankenburg, J.P., of I. Frankenburg & Sons, Ltd., Manchester and Salford.

NEW COMPANIES REGISTERED.

Grimsby Electric Vehicle Co., Ltd. (148,210).—Private company. Registered August 11th. Capital, £5,000 in 1,800 7 per cent. cumulative pref. and 3,200 ord. shares of £1 each. To take over four electric vehicles and the business of an automobile proprietor and carrier carried on by J. Morris, at 67, Wellowgate, Grimsby, also to carry on the business of bakers, wholesale and retail confectioners, &c. The subscribers (each with one share) are: J. Morris, 67, Wellowgate, Grimsby, wholesale confectioner and vehicle owner; Mrs. E. R. Morris, 67, Wellowgate, Grimsby. The first directors are: J. Morris (managing director) and Mrs. E. R. Morris. Registered office: 67, Wellowgate, Grimsby.

A. Chase & Co., Ltd. (148,214).—Private company. Registered August 14th. Capital, £3,000 in £1 shares. Electrical and general engineers, &c. Agreement with A. M. Cole and A. R. Cole. The subscribers (each with one share) are: A. M. Cole, 97, High Street, Teddington, engineer; A. R. Cole, 97, High Street, Teddington, engineer; T. B. Hill, Hillside, Tonning, accountant. The first directors are: A. M. Cole, A. R. Cole, and T. B. Hill. Registered office: 97, High Street, Teddington.

Portable Electric Motors, Ltd. (148,223).—Private company. Registered August 14th. Capital, £2,500 in £1 shares. To acquire certain inventions and rights relating to portable electric cutters, &c. Agreement with G. Fryer. The subscribers (each with one share) are: Lord Clifford of Chudleigh, 18, Haven Green, Ealing, landowner; G. Fryer, 121, Victoria Street, S.W. 1, engineer. The first directors are: Lord Clifford of Chudleigh and G. Fryer. Registered office: 121, Victoria Street, S.W. 1.

Argilla Aluminium Co., Ltd. (148,228).—Private company. Registered August 15th. Capital, £7,500 in 5s. shares. Manufacturers of aluminium and other metals, &c. Agreement with R. D. Mackintosh, M.B. The subscribers (each with one share) are: R. D. Mackintosh, The Bungalow, Mortlake, medical practitioner; P. Evans, 92, Victoria Street, S.W., organiser. Permanent directors: R. D. Mackintosh and P. Evans. Registered office: 92, Victoria Street, S.W.

Chemical Engineering and Wilton's Patent Furnace Co., Ltd. (148,912).—Private company. Registered August 13th. Capital, £30,000 in £1 shares. To take over the business formerly carried on at Hendon by T. Wilton and G. Wilton as the Chemical Engineering Co. and Wilton's Patent Furnace Co., also to carry on the business of electrical engineers, &c. Agreement with N. Wilton and T. O. Wilton. The subscribers (each with one share) are: N. Wilton, 100, Station Road, Hendon, N.W. 4, engineer; T. O. Wilton, 6, Emerson Road, Ilford, E., engineer. The first directors are: N. Wilton and T. O. Wilton, each of whom may retain office while holding 9,000 ord. shares. Registered office: Hendon, N.W. 4.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

David Anderson & Co., Ltd.—Charge on general assets (subject to debentures authorised in 1915), dated July 19th, 1917, to secure £1,000 in favour of Mrs. A. M. Anderson, Putney.

Stuart Turner, Ltd.—Mortgage on freehold premises at Henley, dated July 31st, 1917, to secure £1,250. Holders: L. H. Hanbury, A. T. Hawes, and W. Simonds.

William Taylor Electric Lamp Co., Ltd.—Particulars of £400 debentures created January 29th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Ackroyd & Best, Ltd.—Issue on July 31st, 1917, of £1,300 debentures, part of a series of which particulars have already been filed.

Thomas Pritchard, Ltd.—Trust deed dated July 19th, 1917, securing £6,000 debentures. Property charged: South Staffordshire Tube Works, the business of tube manufacturers carried on there, the company's plant and stock-in-trade, &c. Trustees: A. E. Pritchard, Wednesbury, and Rev. L. A. Pritchard, Sutton Coldfield.

Glantawe Electric Supply Co., Ltd. (112,615).—Capital, £15,000 in £10 shares. Return dated June 20th, 1917. All shares taken up; £15,000 paid. Mortgages and charges: Nil.

Brush Electrical Engineering Co., Ltd. (29,533).—Capital, £253,780 in ordinary stock. Return dated May 21st, 1917. £105,244 issued; £49,312 16s. paid; £55,931 4s. considered as paid. Mortgages and charges: £358,447 4s.

Anglo-Portuguese Telephone Co., Ltd. (24,545).—Capital, £200,000 in £1 shares. Return dated June 26th, 1917. All shares taken up. £51,046 paid; £98,954 considered as paid. Mortgages and charges: £33,940.

Altrincham Electric Supply, Ltd. (40,795).—Capital, £50,000 in 49,650 pref. shares of £1 each and 7,000 shares of 1s. each. Return dated June 4th, 1917. 45,000 pref. and 7,000 ord. shares taken up. £1 per share called up on 40,000 pref., 1s. per share on 5,000 pref., and 1s. per share on 7,000 def.; £40,600 paid. Mortgages and charges: £40,000.

Walter's Electrical Manufacturing Co., Ltd. (94,300).—Capital, £13,000 in £1 shares. Return dated July 18th, 1917. 11,250 shares taken up. £1,250 paid; £10,000 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

Tyneside Tramways Co.

The report of the directors of the Tyneside Tramways & Tramroads Co. states that the surplus of receipts over expenses was £7,490, which, with the balance brought forward from last half-year of £664, makes a total to the credit of profit and loss account of £8,154, and after deducting interest on debentures, loans, &c., amounting to £1,012, there remains an available balance of £7,142. This profit the directors propose to appropriate as follows: In the payment of a dividend on the preference shares at the rate of 5 per cent. per annum (less income-tax), £601; in the payment of a dividend on the ordinary shares at the rate of 4 per cent. per annum (less income-tax), £2,678; in placing to the credit of reserve for renewals, depreciation, and other contingencies, £1,000 (this, with £576 interest on investments, will increase the fund to £27,413); in placing to the credit of special reserve account, to meet contingencies, £1,000; in setting aside for the reduction of registration and formation expenses, &c., £389; leaving to be carried forward to next half-year £1,474. The traffic receipts show an increase of £5,539, compared with the corresponding period of last year.

Electro Bleach & By-Products, Ltd.—Interim dividend of 3¼ per cent. (less income-tax) on the preference shares, payable on September 1st next.

France.—The capital of the Société Francaise des Fonderies et Acieries Electriques, of Paris, is being increased from £40,000 to £100,000.

A new company has been formed in Lyons, with a capital of £20,000, and the title of La Société pour la Création et l'Utilisation des Forces Motrices, to establish hydro-electric plants.

Crossley Bros., Ltd.—Interim dividends of 5 per cent. per annum on both the preference and the ordinary shares for the half-year ended June—the same as last year.

Guildford Electricity Supply Co., Ltd.—The report of the directors, to be presented at the meeting on Monday next, states that the gross receipts for the past year were £12,792, as compared with £12,098 for the year 1915, thus showing an increased revenue of £694. There is a balance on the revenue account of £2,657 (after crediting depreciation fund account with £572), as compared with a balance of £1,380 on the revenue account for 1915, when no provision was made for depreciation. After making due provision for debenture interest, interest on temporary loans, and the placing of £514 to the credit of reserve fund account, the net revenue account shows a balance of £289, and the directors recommend that this balance be carried forward to the credit of the net revenue account for the present year. The company during the past year has again suffered owing to the increased cost of production of electricity, and also to some extent by the decrease in the sale of current for lighting purposes. To meet these difficulties the directors were compelled again to increase the company's charges for current for all purposes as from the end of June quarter, 1916.

Reduction of Capital.—*Creed & Co., Ltd., and Reduced.*—The order confirming the reduction of the capital of this company from £130,000 to £90,000 was registered by the Registrar of Joint Stock Companies on August 9th.

Stewarts & Lloyd.—Interim dividend for the half-year ended June 30th at the rate of 10 per cent. per annum on the preferred ordinary shares, to be paid on August 31st, the same as a year ago.

Blackpool & Fleetwood Tramroad Co.—An interim dividend of 4 per cent. per annum, free of income-tax, on the ordinary shares has been declared. The same rate was paid a year ago.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the four weeks ended June 29th, 1917, amounted to 2,230,711, compared with 1,866,546 units in the corresponding four weeks of 1916.

STOCKS AND SHARES.

Tuesday Evening.

Various of the electric lighting shares are quoted ex dividend, but this has not checked further advances in their prices. That is to say, the amount of the deduction has been more than recovered; and the prices of the shares are decidedly good. Rises have occurred in Charing Cross ordinary and preference, County, St. James's, City of London, Metropolitans, and Westminsters. The market is good all round, and has received a little attention in consequence of an article in one of the evening papers suggesting that investors will find in this section excellent opportunities for cheap purchases.

The advice would be very sound, were it not for the fact that there are scarcely any shares to be had; and the little demand which arose as a result of the article found no amount of stock worth mentioning ready to supply it. This, of course, has been pointed out in these notes from time to time. The best way of securing shares is to leave an order with a stockbroker that he shall pick them up at a fixed price whenever any happen to come to market; otherwise, the would-be purchaser is likely to be disappointed, and, after waiting some time, will probably elect to put his money into something else.

The threatening aspect of affairs in the railway world caused a natural dulness amongst the various issues of the steam companies, and most prices are lower on the week, despite the calmer complexion that the trouble assumed on Tuesday. The depression coloured to some extent the stocks of the electrically-driven concerns. Districts, for instance, are down to 15. Metropolitans keep steady at 22¾. The income bonds of the Underground Electric Railways are maintained by the consideration that the price carries £2 net dividend in it at the present time, and, accordingly, it shows another rise of ¼ at 82½.

From the spectacular point of view, the most interesting features in the Stock Exchange at the moment are those connected with Mexico. Carranza is declared, by those who profess to know what they are talking about, to entertain a new-born friendliness for the railway systems and the utility companies. Whether this be so or not, the prices of all the stocks have advanced hand over fist, and come, of course, upon the top of substantial improvements a week ago.

Mexican Tramway 5 per cent. bonds at 44½ are 4 points up, following their previous rise of 4½. Mexican Light & Power preferred at 29½ is also 4 points to the good, after its rise of 3 last week. Pachuca Fives at 35½ are up 7, and Monterey Fives at 23½ have also gained several points. The same tendency is noticeable in everything else pertaining to Mexico, but, as those who follow the course of these markets are fully aware, it requires very little demand to push up prices; and a rise of a few points can easily be secured in some particular security without any stock at all changing hands.

Foreign descriptions are very firm throughout, although British Columbia deferred has lost part of its rise of last week, and at 20 is 1 to the bad. A little buying of Anglo-Argentine Tramway issues is reported. Brazilian Tractions remain at 49. Bombay Electric preference at 9½ are ex dividend.

Cable stocks and shares show no diminution of strength. Indo-Europeans have risen £1. Eastern Extensions are ¼ higher. Westerns are up ¼. The Telephone list is equally good. Chiles and United River Plates are both 1/16 higher. The rise in Marconis is well maintained; the shares now are quoted 3 1/16, ex the dividend of 2s. There is a fair amount of business doing in this department, but there would be more were there a sufficiency of shares to satisfy the would-be buyers.

British Aluminium ordinary are 1/32 better at 31s. 3d. British Insulateds put on 7s. 6d. to 13¼, and Castner-Kellners are good at 3 7-16. Nearly all the sections given up to industrials exhibit prominent strength. For August, there is quite a lot of business doing.

This applies also to rubber shares, where a large volume of business has been accompanied by very little alteration in quotations, arguing that the buying is fairly well balanced by the selling. The iron and steel market would be better were it not for the labour difficulties, which it is feared may radiate from those engendered by the minority Union of the railwaymen. The armament group is quiet; and amongst base-metal shares, notwithstanding the prices now current for the metals themselves, there is but little doing.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1915.	Dividend 1916.	Price Aug. 21, 1917.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	9	6¼xd	—	£7 4 0
Charing Cross Ordinary	5	5	8¾xd	+4/-	6 9 0
do. do. do. 4½ Pref.	4½	4½	8¾xd	+2/-	6 15 4
Chelsea	4	3	3½	—	5 4 4
City of London	8	8	13	+ ½	6 3 3
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	11⅜	+ ⅛	6 3 1
do. 6 per cent. Pref.	6	6	10½	—	5 17 1
Kensington Ordinary	7	6	6¾xd	+2/3	5 14 3
London Electric	3	3	1	—	Nil
do. do. 6 per cent. Pref.	6	4	8⅜	—	5 6 8
Metropolitan	5	5	9¼xd	+1/-	5 9 1
do. 4½ per cent. Pref.	4½	4½	3½	—	7 4 0
St. James' and Pall Mall	8	8	7	+ ½	5 14 6
South London	5	5	3⅜	—	7 5 6
South Metropolitan Pref.	7	7	21/6	—	6 10 3
Westminster Ordinary	7	7	6¼xd	+8/-	5 12 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	98	—	6 2 5
do. Def.	32/6	1½	22⅜	—	6 16 4
Chile Telephone	8	8	7⅞	+ 1/16	5 13 4
Cuba Sub. Ord.	5	5	8⅜	—	5 17 8
Eastern Extension	8	8	14½	+ ½	*5 9 4
Eastern Tel. Ord.	8	8	144½	+1	*5 10 9
Globe Tel. and T. Ord.	7	7	12⅜	—	*5 9 10
do. Pref.	6	6	10⅜	—	5 15 8
Great Northern Tel.	23	24	86	—	6 13 4
Indo-European	13	13	54½	+1	5 19 3
Marconi	10	15	3 1/16xd	—	4 15 10
Oriental Telephone Ord.	10	10	22	—	8 12 9
United R. Plate Tel.	8	8	6¼	+ 1/16	*5 19 8
West India and Pan.	6d.	6d.	1/16	—	1 12 0
Western Telegraph	8	8	14½	—	*5 10 4
Home Rails.					
Central London, Ord. Assented	4	4	61½	—	6 10 1
Metropolitan	1	1	22⅞	—	4 8 6
do. District	Nil	Nil	15	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅜	—	Nil
do. do. "A"	Nil	Nil	5/8	—	Nil
do. do. Income	6	4	82½	+ ½	*4 17 0
Foreign Trams, &c.					
	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	5	—	6 0 0
Anglo-Arg. Trams, First Pref.	5½	5½	3⅝	—	9 11 4
do. 2nd Pref.	5½	—	2⅜	—	—
do. 5 Deb.	5	5	67	—	7 9 3
Brazil Tractions	4	4	49	—	—
Bombay Electric Pref.	6	6	9⅜xd	—	6 4 8
British Columbia Elec. Rly. Pfce.	5	5	47½	—	10 10 6
do. do. Preferred	Nil	Nil	21	—	Nil
do. do. Deferred	Nil	Nil	20	−1	Nil
do. do. Deb.	4½	4½	56	—	7 14 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	44½	+4	Nil
do. 6 per cent. Bonds	Nil	Nil	35½	—	Nil
Mexican Light Common	Nil	Nil	18	+2½	Nil
do. Pref.	Nil	Nil	29½	+4	Nil
do. 1st Bonds	Nil	Nil	46½	+4½	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅜	—	4 15 10
British Aluminium Ord.	7	10	1⅞	+7½d	9 8 0
British Insulated Ord.	17½	20	13½	+ ⅜	7 11 3
British Westinghouse Pref.	7½	7½	2½	—	5 11 6
Callenders	20	20	14½	—	7 0 6
do. 5 Pref.	5	5	4⅜	—	6 1 3
Castner-Kellner	22	22	3 7/16	+ 1/16	6 8 0
Edison Swan, fully paid	—	—	1⅜	—	Nil
do. do. 4 per cent. Deb.	4	4	71½	—	5 12 0
Electric Construction	7½	7½	4⅜	—	8 0 0
Gen. Elec. Pref.	6	6	10½	—	5 17 1
do. Ord.	10	10	16	—	6 5 0
Henley	25	25	16	—	7 16 3
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	12	12	12⅜	+ ⅛	*7 6 10
Telegraph Con.	30	30	38½	—	*6 5 3

* Dividends paid free of income-tax.

SECOND REPORT OF THE COMMITTEE FOR THE INTERCONNECTION OF THE LANCASHIRE AND CHESHIRE ELECTRICITY SUPPLY SYSTEMS.

(*Continued from page* 153.)

Basis for Determining the Charges for Electricity Supplies.—15. The Committee consider it of importance that some basis for arriving at the costs for the different classes of supply should be put forward in this report.

They fully recognise the complexity of this problem, and consider it impossible to formulate any uniform rate or rates.

16. Bulk Supplies.—By a bulk supply is implied a supply afforded by one undertaking to another under an agreement for a defined period, and which is available at all times from the undertaking giving the said supply, and the undertaking receiving the same agrees to use regularly for supplying the usual requirements of consumers in his district.

The Committee recommend that—as a general rule—only those stations now employing or about to employ individual generating sets of not less than 5,000 kw. capacity should in the future be used for bulk supply purposes.

The items which should be included in the cost per unit at the bus-bars of the supply station are:—(*a*) Capital charges on generating plant, (*b*) working expenses of generating plant, (*c*) coal.

(*a*) Capital Charges on Generating Plant.—The pre-war cost of installing a complete plant using modern sets of not less than 5,000 kw. will not be found to vary greatly as between one locality and another. The Committee propose that the figure should be taken out in each case and the total annual charges thereon, calculated at 10 per cent., should be expressed in £ per kilowatt of maximum demand (kw.d.).

(*b*) Working Expenses (Generation only).—Under this heading are included:—

Coal (Stand-by)	Expressed in £ per kilowatt of maximum demand per annum.
Oil, Waste, Water, and Stores ...	
Wages and Salaries	
Repairs and Maintenance	
Management	

Although not strictly accurate, the method of treating the above working expenses as an annual charge per kw.d. greatly simplifies the calculation, and is sufficiently near theoretical accuracy for all practical purposes.

No allowance has been made in any of the above estimates for rates and taxes, as the Committee are of opinion that all plant at power stations used for electrical supplies delivered outside the area in which the power station giving the supplies is situated should be exempted from local taxation.

(*c*) Coal (Running).—The Committee recommend that the item of total fuel costs should be based on a consumption of 28,000 b.th.u. per unit delivered to feeders at stations, with a 30 per cent. load factor, provision being made for a variation in the price of fuel. The allocation of the total fuel costs between "running" and "fixed" expenses being determined according to load factor.

A numerical example is given in a schedule, from which it is seen that for a 30 per cent. load factor the costs delivered to feeders at the station bus-bars equal £2 6s. per kw.d. per annum, plus .168d. per unit.

A table is also included in the schedule showing a suggested variation in the price per unit for load factors above and below 30 per cent.

Alternatively, this variation may take the form of a reduction in the running charge of .168d. per unit of from 1 per cent. to 7½ per cent. for load factors between 30 per cent. and over 50 per cent., and an increase in the said running charge of .168d. per unit of from 1 per cent. to 200 per cent. for load factors between 30 per cent. and 10 per cent.

The undertaking receiving the bulk supply shall declare its maximum demand in kilowatts, which may be exceeded to the extent of 15 per cent. only.

In arriving at the fixed charges to be paid per annum to the supplying authority, the actual recorded kw.d. at the station supplying shall in every case be taken. There shall be a minimum fixed charge per annum payable in respect of all bulk supplies by the purchasing authorities, which minimum shall be based on 85 per cent. of the said declared maximum demand.

All bulk supply agreements shall be entered into for a minimum period of 12 months.

The bulk supply rates ascertainable in the manner put forward by the Committee shall only be applicable to authorities purchasing supplies involving a kw.d. of not less than 500.

17. Stand-by Supplies.—By a stand-by supply is implied a supply given under an agreement for a definite period which one undertaking is under a distinct obligation to give to any other undertaking—if called upon to do so—at any hour of the day.

Stand-by supplies are capable of being divided into two classes:—

A.—Those in which energy is actually supplied by one undertaking to another at certain periods (including peak-load hours) for varying reasons, *e.g.*, breakdowns of plant, new plant under construction not completed by contract date, &c.

B.—Those in which no energy may pass although the supply authority is standing by the whole time. This class of stand-by supply may be termed an insurance against accidents.

The rates for Class A supplies shall be determined on the actual kw.d. recorded at the supply station, and, as far as possible, shall be based on the rates put forward for bulk supplies, with due regard to all local circumstances or special conditions.

The prices for Class B supplies at the bus-bars of the supplying station shall be determined at the rate per annum per kilowatt of maximum demand of the guaranteed stand-by corresponding to 33⅓ per cent. of "the capital charges" per annum set forth under "bulk supplies."

For all energy that may pass under the Class B supplies the rate per unit shall be in accordance with the overall costs according to load factor set forth in the table for bulk supply.

18. Emergency Supplies.—The Committee consider that it is difficult, if not impossible, to formulate charges for a supply of this character. Under certain conditions the rates set out under either bulk supplies, stand-by supplies, or reciprocal supplies might be applicable, depending to a large extent on the capability of adjacent undertakings to afford such supply at the time it is required. Moreover, in an extreme emergency, and in order to avoid a partial shut-down, it may be necessary for certain undertakings to incur heavy additional costs through having to temporarily use small or obsolete plant. In all cases, therefore, the charges under this heading would be determined by the district boards after investigating the circumstances.

19. Reciprocal Supplies.—These supplies may be given during periods of light load, or heavy load, or both.

A.—*Light Load Periods.*—Light load periods may be taken to mean 6 p.m. to 6 a.m. daily, and 12 noon Saturday to 6 a.m. Monday; holiday times, and such other hours, if any, between 6 a.m. and 6 p.m., as may be mutually agreed between undertakings.

The Committee propose that the rates for this class of supply, at the bus-bars of the supplying station, shall be determined as follows:—

(*a*) 33⅓ per cent. of the capital charges per kw.d. per annum.

(*b*) 25 per cent. of the working expenses per kw.d. per annum.

(*c*) A running charge per unit to cover the cost of fuel.

A numerical example of the application of the above proposed basis for this class of supply is given in a schedule, assuming a load factor of 30 per cent.

In every case the kw.d. shall be the actual maximum demand at the supply station bus-bars.

One week shall be taken as the minimum period in arriving at the kw.d. charge.

B.—*Heavy Load Periods.*—These are defined as being all other periods than those specified for the light load periods.

The rates applicable to this class of supply are the same as for bulk supplies.

Basis for Allocating the Capital Charges on Interconnecting Mains, Transformers, and Switchgear against the Revenue Accounts of the Participating Authorities.—20. As previously provided, each participating authority shall—where necessary—apply to the proper Government authority for borrowing powers for the interconnecting mains to be laid within its own statutory area. Each authority shall in like manner apply for the borrowing powers in respect of transforming plant and switchgear required for interconnecting purposes. If interconnecting mains have to be constructed in any area intervening between the statutory areas of two participating authorities, each of the participating authorities shall apply for borrowing powers for one-half of the cost of such mains.

21. The capital and maintenance costs for interconnecting mains and plant shall be allocated by the board against the respective participating authorities on the basis that each authority shall pay the proportion of such costs corresponding to his user of the said mains and plant. In making the allocation the board will give due regard to the potential and actual demand of each authority, the amount of energy transmitted, and the purpose for which such energy is required, *i.e.*, for bulk, stand-by, or reciprocal supplies.

22. When new or existing mains and plant are used partly for interconnecting and partly for supplies to industrial or other consumers, the board shall allocate a proportion of the total capital and maintenance costs incurred in affording such supplies, and shall charge this proportion against the authority or authorities supplying such industrial or other consumers, the balance of the costs to be allocated as set out in Clause 21.

23. The maintenance of all interconnecting mains and plant shall (unless otherwise directed by the board) be carried out by the authority in whose area such mains and plant are situated. In the event of a portion of the interconnecting main being situated in any area intervening between the statutory areas of two participating authorities, the maintenance of such portion shall be carried out (unless otherwise directed by the board) by the authorities at whose cost the mains have been provided.

24. The rates of charge set forth previously for bulk sup-

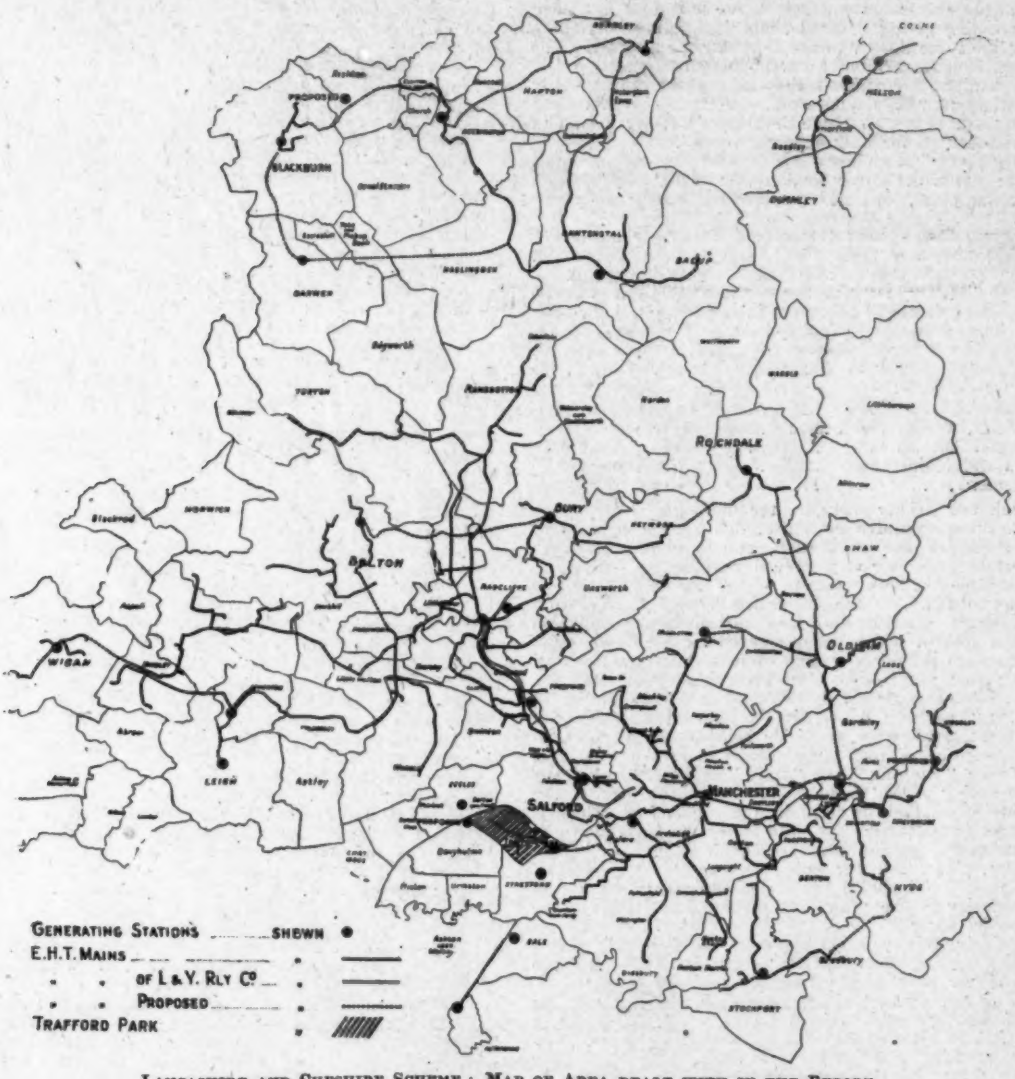
plies, stand-by supplies, and reciprocal supplies are given in terms of units delivered to feeders from the bus-bars of the supplying generating stations. As supplies given by interconnecting mains between various authorities may sometimes be metered at the boundaries of the respective areas of supply, and sometimes at the bus-bars of the receiving station, it is proposed to add a percentage to the overall costs (per KW. demanded) and per unit supplied as previously laid down to cover transmission and transformation losses. These losses are estimated to fall within the following limits:—

Transmission losses ..... 1 per cent. to 2 per cent. per mile.
Transformation losses ... 2½ per cent. to 5 per cent.

25. As the interconnecting mains between the various undertakings will in most cases pass through the areas of several rating authorities, and would therefore become liable under existing methods of rating to repeated taxation, and as the mains are to be used for mutual and national benefit, statutory authorities owning the interconnecting mains should—subject to the terms of Section 6 of the 1909 Electric Lighting Act—be allowed to furnish a supply to the said premises.

27. The Committee, in setting forth above the basis of charges for supplies, have not made provision for any "direct" profit on sales thereon for the purpose of rate-aid, which must therefore—in the absence of any legislation—be left to be decided by each undertaking as at present, in accordance with the accepted local policy.

The Committee cannot refrain, however, from giving expression to the opinion that the practice of making profits for the purpose of handing over substantial grants in aid of local rates is detrimental to the interests of an adequate and economical supply of electricity, particularly for industrial purposes. On the other hand, they would lay stress on the necessity of making adequate provision for depreciation and obsolescence of plant.



Lancashire and Cheshire Scheme: Map of Area dealt with in the Report.

the Committee is of opinion that all interconnecting mains and plant should be entirely exempted from assessment for rating purposes unless used for distributing supplies to consumers. The Committee would point out that the methods of assessing electrical mains and plant differ in the various localities, and unless special protective provisions are introduced with regard to rating interconnecting mains, rates will be charged on supplies in one district for which corresponding rates have already been paid in other districts. It would be obviously unfair to rate mains used for exchanging supplies between stations on the same basis as mains used for distributing supplies within the areas of the participating authorities.

Miscellaneous Provisions.—26. The Committee have considered the possibility of interconnecting mains being laid in the area of a statutory authority who is unable or unwilling to afford a supply of electrical energy to the premises in his area of industrial or other consumers requiring a supply.

They therefore recommend that one or both of the adjacent

28. Whilst the Committee are of opinion that, broadly speaking, no direct profits should be made on the supplies enumerated in this report, a possible exception may arise in the case of electricity supplies which are given to *new industries* established in an area other than that of the authority containing the source of the supply.

In this instance the establishment of the new works brings increased rateable value to the district in which they are established, and if, as may very well prove to be the case, the inducement to establish such new industries in the selected area was a supply of cheap electricity (purchased from another authority) it appears only reasonable for the supplying authority to expect some direct return on the sale of current.

Summary of Recommendations on Interconnection.—29. As a preliminary step it is essential that a scheme of interconnecting the power stations of certain of the existing electrical undertakings in Lancashire and Cheshire should be at once proceeded with.

30. That the proper authority to control this movement

would be a local joint board, on which local authority and company interests are represented in the manner set forth in the foregoing report.

31. That the existing rights of all electrical undertakings as distributors should be observed within their statutory areas.

32. Any undertaking adversely affected financially by reason of the co-ordination of the interconnected power stations should be reimbursed by the participating authorities.

33. That the basis for costs of supply between authorities and all charges in relation to expenditure on interconnecting mains and plant should be determined by the joint board in the manner described in the report.

The Conferment of Additional Powers upon the Joint Board in regard to the Establishment and Control of all Future and Existing Power Stations and High-Pressure Transmission Lines.—34. The Committee recognise that the matters dealt with under this section of the report are somewhat outside the strict terms of their reference, but the future economical development of electricity generation and supply on a large scale is so bound up with the question of interconnection of existing undertakings that this report would not be complete without a reference to the larger question.

35. The Committee would again reaffirm their opinion that it is not desirable or necessary to interfere with the existing rights of undertakings with regard to the distribution of electricity within their statutory areas.

36. During the course of its deliberations on "interconnection" the Committee had under consideration the necessity in the near future of making provision for a much larger output than is at present called for, thus necessitating the erection of new power stations or additions to existing stations which would be used (in conjunction with the new and existing systems of high-pressure interconnecting mains) to furnish supplies to areas now served by a number of existing undertakings.

37. The units generated by the undertakings included within Groups A, B, C, and D amounted to 421,000,000 units for the year ending March 31st, 1916. Under normal conditions the rate of increase is about 20 per cent. per annum, so that during the next five years the output may be expected to increase to at least 1,000,000,000 units, and the maximum load, which for the year ended March 31st, 1916, amounted to 138,429 KW., will have correspondingly increased to 300,000 KW. The average increase in load is, therefore, equal to 32,000 KW. per annum for the whole of the groups.

38. The Committee have carefully considered how this increase in production can be met so as to achieve the most economical results, both in the employment of capital and in reduced operating expenses.

39. In some districts it may be desirable to increase the capacity of existing stations, while in others it will be necessary to erect new power stations. In both cases the new plant will consist of large units which will be used in conjunction with the new and existing systems of high-pressure interconnecting mains to furnish the total supply to certain statutory areas, and to augment the existing supply to others.

40. In the preceding report dealing with interconnection the Committee, in order to ensure the most economical results, recommend, *inter alia*, that powers should be conferred on the joint board to co-ordinate and prescribe the running hours of existing stations and to act in an advisory capacity in regard to all proposals for future extensions of generating plant. The joint board, as one central body, will therefore exercise some of the powers at present administered by each existing statutory authority.

41. The Committee have considered whether the new power stations required to supply more than one authority should be erected and operated by a combination of the authorities more immediately interested in the use of such power stations as contemplated in Section 8 of the Electric Lighting Act, 1909 (subject to the powers of the joint board as previously set out), or whether the erection and operation of such new power stations should be provided at the cost of, and be operated by, the joint board, thus necessitating the conferment of financial and administrative powers upon the joint board.

42. In the ordinary course of development, as indicated in Clause 37, a considerable improvement would no doubt result over present methods if, in certain localities, new power stations were erected at the cost of those authorities who, for the present or immediate future, will obtain their supplies from such a source, but as such power stations increase in size, and the area over which their supply is given also increases, a larger number of authorities become interested in the operation of the stations, and will naturally require representation in their administration.

43. As the new stations will be interconnected with each other, it appears inevitable that there must be a general co-ordination of effort, first in localities, then in districts, and finally in the larger area covered by this report. In view of this inter-relationship between existing statutory authorities in the different localities and districts, the Committee are of opinion that ultimate developments may lead to a complete federation of the interests of the whole of the different authorities in the area.

44. Many advantages would be derived if the financial and controlling powers now exercised by the various company and municipal undertakings in the areas under consideration were centred under one owning and operating authority. The time involved and expense at present incurred by individual undertakings and Government departments in connection with the procedure for raising and repaying capital would be greatly reduced. The apportioning of the capital and maintenance charges on plant and mains used for interconnected supplies between the various participating authorities would be avoided. All questions of profit, direct or indirect, between one authority and another would be eliminated, and by reason of centralised and collective ownership there would be more effective control than would be possible under any scheme of individual ownership.

45. The initiation of such a scheme at the present time presents certain difficulties which cannot be overlooked. The capital expenditure per kilowatt of plant installed, the cost per unit generated, and the selling price to industrial consumers vary so considerably as between one authority and another that the owning and operating of the whole of the existing power stations by a central authority might, unless adequate safeguards are provided, adversely affect those authorities who at present have the benefit of low capital expenditure, low generating costs, or favourable local conditions, to the immediate benefit of other authorities who do not possess these advantages.

46. Under the interconnection scheme, it seems inevitable that some of the less efficient power stations must be superseded in favour of more economical supplies from the new power stations, or from new plants installed in the more favourably situated existing stations, and it appears to the Committee that in such cases the undertakings so affected must necessarily be relieved of the financial obligations resting upon them in respect of superseded plant.

47. The difficulties referred to in Clause 45 will be largely overcome as the less efficient power stations are superseded, because the capital expenditure per kilowatt and the generating costs of the remaining stations in the various localities will tend to become approximately the same. The Committee feel, therefore, that while the rights of the statutory authorities should be maintained as regards the distribution and sale of energy, it may be desirable in order to secure a closer co-ordination of effort to invest the joint board with further powers to erect new power stations, and to acquire when and where necessary the ownership and control of existing power stations. The Committee recommend that powers to acquire existing stations should only be exercised after the joint board has approved thereof by a two-thirds majority, and would be subject to the sanction of the proper central Government tribunal. Any authority whose undertaking is being acquired would have the right of appeal to the tribunal on all questions, financial and otherwise, relating to the action of the joint board.

In the case of companies, these proposals would probably involve the purchase of their entire undertakings.

48. In the event of a power station being purchased under Clause 47, the joint board shall supply energy to the authority owning such power station at a price not exceeding the cost at which energy was produced at the said power station during the preceding 12 months, but all such prices shall be subject to revision at the close of each financial year, due regard being had in each case to all the factors entering into the costs of production.

(To be concluded.)

Testing for Troubles with a Telephone Receiver.—One of the most useful devices for locating wiring troubles is a headband receiver of from 250 to 500 ohms resistance—the same type of receiver as is used by telephone operators. This type has the advantage of allowing the free use of both hands for testing.

In testing for door bell trouble, for instance, remove the cover from the push button, touch one cord end to each terminal, and listen. If no sound is heard in the receiver it is an indication that the circuit is clear and the wiring is all right. If a frying noise is heard it indicates a loose joint or poor connection on the circuit—on the bell, probably. If the terminals are pushed together to ring the bell while the receiver cords are still connected and a sharp back kick is heard in the receiver, it indicates that the bell is either short-circuited or the tension on the clapper is too great. If there is a rattling sound, the bell has been ringing. If every operation produces but a very faint response in the receiver, it means that the battery is weak.

After a little practice the trouble man can soon find very many uses for a receiver of this kind. By this push-button test method, trouble can be readily located and remedied. A double receiver headband should never be used, but a single one, so as to have one ear free for listening to outside noises.—*T. and T. Age.*

Municipal Tramways Conference, 1917.—This year's annual meeting of the Municipal Tramways Association will be held at Blackpool on September 20th and 21st (headquarters, Savoy Hydro). Amongst the subjects for discussion are "Principles to Adopt to Ensure the Highest Net Earning Capacity," by Messrs. Holford, Barnard and Priestley; "Rules of the Footpath," by Mr. J. Dalrymple; "Differentiation in Tramway Fares," by Mr. W. Murray; and the "Development of Tramways." The annual general meeting will be held on September 21st.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

SALVADOR.—In reporting the issue of a Decree making certain modifications in the Customs Tariff of the Republic, H.M. Consul at San Salvador states that Customs duties on imported goods are now payable as follows:—5 per cent. in U.S. currency, 10 per cent. by a draft on the United States, and 85 per cent. in local currency, at the exchange of the day. Electrical goods do not appear to be affected by the Decree itself.

CHILE.—A Presidential Decree has been issued providing that, as from January 29th, import and export duties, warehouse, lighthouse and buoy dues, and consular fines shall be collected as follows:—All with the exception of export duties are to be paid in currency, with a surcharge which is to be fixed weekly according to the average price of gold. Export duties are to be paid as to 50 per cent. in notes with the corresponding surcharge, as indicated above, and 50 per cent. in drafts on London at 90 days' sight, the amount in drafts to be paid for each gold peso to be determined according to the average exchange value of drafts, which is also to be ascertained weekly. From March 1st only 30 per cent. of the export duties is to be paid in drafts, the remaining 20 per cent. (to make up the 50 per cent.) being paid in national gold coin.

By a Decree dated January 26th a new form of consular invoice has been brought into use for merchandise shipped to Chile, which requires, *inter alia*, that each class of merchandise shall be designated in the invoice itself, and should there be various kinds of any class of goods each particular kind must be stated. Invoices are to be in Spanish throughout, and if the Chilean Consul who legalises the invoice considers that the value declared in it is not the current market price of the goods, he may note at the foot what he considers to be the true value. The Decree took effect in Chilean Consulates on May 1st, and in Chilean Customs Houses on July 1st.

ITALY–BRAZIL.—The Italian Government have denounced the provisional Commercial Agreement between Italy and Brazil of July 5th, 1900, and the Agreement will accordingly cease to have effect at the end of 1917.

BRAZIL.—An official intimation has been made that the new consular invoice regulations contained in the Budget Law for 1917, and in the subsequent Decree—see the REVIEW of April 20th—have been modified in view of the objections raised.

It is now required that invoices shall be presented for consular "legalisation" before the *arrival* of the vessel conveying the merchandise at the port of destination in Brazil (this supersedes the requirement that the invoice must be taken out before the *departure* of the vessel).

A fine will be levied on the consignee in Brazil only in cases where any discrepancy that may be discovered between the declaration contained in the consular invoice and the actual contents of packages is such that a *greater* amount of duty is leviable on the goods than would have been levied had the consular invoice declaration been accepted by the Customs without question.

All packages must be numbered, *if possible* in consecutive order; in no case may the same number be used more than once in numbering packages included in one and the same consignment (the Budget Law required consecutive numbering of packages).

NORWAY.—The exportation of carbon electrodes and electrodes for industrial use, electrode scrap, and retort graphite has recently been prohibited.

SWEDEN.—As from May 26th the exportation of the undermentioned goods has been prohibited:—

Insulating compositions, also manufactures of the compositions;* mercury and mercury alloys (amalgams);*. vulcanised fibre and other chemically prepared fibre board in plates or sheets; vulcanised fibres in tubes or rods. (*Extensions of existing prohibitions.)

NETHERLANDS.—The Board of Trade are informed by H.M. Consul-General at Rotterdam that a statistical tax at the rate of one per mille (one-tenth per cent.) *ad valorem* is now leviable on all goods imported into, or exported from, the Netherlands, in order to defray the expenses of a Bureau which has been established to compile Customs, &c., statistics.

TERRITORY KNOWN AS "GERMAN EAST AFRICA."—Regulations have been issued by the Senior Military Customs Officer at Dar-es-Salaam setting out the conditions under which goods in transit through the occupied territory in "German East Africa" may be conveyed through the ports of Bukoba and Muanza. The text of these regulations was given in the official *Board of Trade Journal* for May 24th.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford

11,350. "Printing-telegraphy." F. RITCHIE. August 7th.
11,357. "Magnetic blocks for holding iron and steel during grinding, planing, &c." G. KHISANACHVILI. August 7th.
11,358. "Means for controlling electric circuits." W. O. KENNINGTON. August 7th.
11,360. "Alternating-current generator and group converter." SOC. FRANÇAISE RADIO-ELECTRIQUE. August 7th. (France, August 4th, 1916.)
11,380. "Thermo-electric generators." M. SANTANGELO. August 8th.
11,389. "Lamps or lanterns for aircraft." H. C. BROWN. August 8th.
11,390. "Lampholders for electric lamps." H. C. BROWN & FULLER ACCUMULATOR CO. August 8th.
11,392. "Electric transforming and converting apparatus." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). August 8th.
11,410. "Spark arresters." F. A. LAGRANGE, J. P. O'DONNELL & P. C. SACCAGGIO. August 8th.
11,420. "Ignition devices for internal-combustion engines." W. O. KENNINGTON. August 8th.
11,440. "Igniting spark for internal-combustion engines, shot-firing magnetos, &c." L. C. GRANT. August 9th.
11,457. "Ignition apparatus for aviation engines." SOC. LORRAINE DES ANCIENS ETABLISSEMENTS DE DIETRICH ET CIE DE LUNEVILLE. August 9th. (France, August 16th, 1916.)
11,465. "Interrupter for electric circuits." R. BOSCH. August 9th.
11,486. "Apparatus for rectifying high-tension discharge from transformers, &c." B. H. MORPHY. August 10th.
11,489. "Dynamo-electric machines." J. FRASER. August 10th.
11,490. "Control of electric motors, applicable to cranes, hoists, &c." J. HENRY. August 10th.
11,497. "Electrical distilling apparatus." D. B. JONES. August 10th. (U.S.A., December 7th, 1916.)
11,505. "Electrical induction apparatus." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). August 10th.
11,506. "Alternating-current circuits." R. H. LONG. August 10th.
11,511. "Art of electric welding." S. C. CARY. August 10th.
11,528. "Electric cables or conductors." T. S. SEYMOUR. August 10th.
11,531. "Compasses and instruments for detecting changes of magnetic declination." R. L. GLAZEBROOK & F. E. SMITH. August 10th.
11,534. "Magnetic compasses and electric lamps for use therewith." R. S. MASON. August 10th.
11,544. "Sparking control of aviation engines." M. G. SMILES, W. D. SMILES & W. T. WARREN. August 10th.
11,579. "Sparking-plug tester." J. HANMAN. August 11th.

PUBLISHED SPECIFICATIONS.

1916.

The numbers in parentheses are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

5,842. DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. & F. P. Whitaker. April 20th, 1916. (107,903.)
5,858. ELECTRIC FUSES. A. F. Berry. April 20th, 1916. (107,904.)
5,859. ELECTRIC HEAT RADIATORS. A. F. Berry. April 20th, 1916. (107,905.)
10,023. ELECTRIC JOINT-MAKING WASHER. C. J. Beaver & E. A. Claremont. July 17th, 1916. (108,015.)
10,178. CONTROLLERS FOR ELECTRIC MOTORS. W. B. Bennitt. July 19th, 1916. (108,030.)
11,300. ELECTRIC HEATERS FOR WATER AND OTHER LIQUIDS. Benham & Sons, and C. R. Allensby. August 11th, 1916. (108,045.)
12,306. ELECTRIC FURNACE. I. Rennerfelt. September 8th, 1915. (101,412.)
12,561. DYNAMO-ELECTRIC MACHINES FOR COMBINED ELECTRIC LIGHTING AND IGNITION IN CONNECTION WITH MOTOR-DRIVEN VEHICLES AND THE LIKE. W. Holt & B. Brooks. September 5th, 1916. (108,062.)
17,752. ELECTRIC FIRE OR RADIATOR. H. H. Berry. December 9th, 1916. (108,097.)
18,160. ARRANGEMENT FOR AUTOMATICALLY ADVANCING THE IGNITION IN EXPLOSION ENGINES. Soc. Anon. pour l'Eclairage Electrique des Vehicules. December 29th, 1915. (102,958.)
18,504. ELECTRIC STARTERS FOR INTERNAL-COMBUSTION ENGINES. A. H. Midgley and C. A. Vandervell & Co. December 27th, 1916. (108,114.)

1917.

438. HIGH-FREQUENCY ALTERNATORS. J. Bethenod & E. Girardeau. August 10th, 1915. (Divided application on 10,576/16.) (103,657.)
2,022. IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. J. J. Murray. April 13th, 1916. (Divided application on 5,460/16.) (108,124.)
2,332. SEALING AND BONDING GLANDS FOR ELECTRICAL JUNCTION BOXES. G. S. Boothroyd and Callender's Cable & Construction Co. February 16th, 1917. (108,125.)
3,091. CARRIER OR MEANS FOR SUPPORTING ELECTRIC-LAMP OR OTHER SHADES, REFLECTORS AND THE LIKE. A. P. Rutherford. March 2nd, 1917. (108,129.)
6,196. ELECTRIC IRONS AND THE LIKE. Cable Accessories Co., F. H. Reeves and P. W. Davis. May 2nd, 1917. (108,141.)

Decimal Coinage.—The Decimal Association has issued a pamphlet on the subject of British Decimal Coinage, dealing with the choice of unit; the Association considers that the question is narrowed down to the choice of the sovereign or the dollar, the former involving no change in the values of our gold and silver coinage, but a change of 4 per cent. in value of the bronze coinage, while the latter would retain the bronze coins at their existing values, but would change all the rest, including the pound sterling. The Association is clearly in favour of the retention of the pound, divided into 1,000 mils, but invites the expression of opinions from all who are interested in the subject. The view which we have always advocated, and to which we adhere, is that the pound should be retained unchanged in value.